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REPORT ON

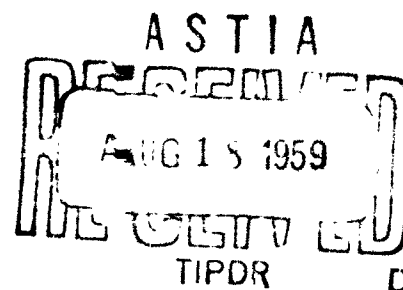
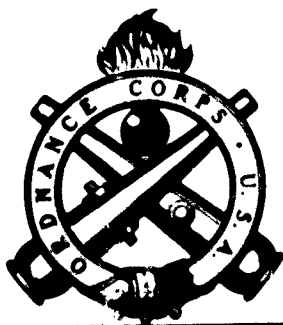
BALLISTIC EVALUATION OF ALUMINUM ARMOR (U)

First Report On Ordnance Project No. TB4-005

(AD-1274)

T. J. GRIFFIN

AUGUST 1959



Aberdeen Proving Ground
Maryland

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DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

AUTHORITY: ORDBA-1320
PRIORITY : 1A

TJGrlf: 14/v1/32175

BALLISTIC EVALUATION OF ALUMINUM ALLOY ARMOR

First Report on Ordnance Project No. TB4-005

(AD-1274)

Dates of Test: March to June 1959

ABSTRACT (U)

Thirteen aluminum alloy armor plates varying in thickness from 1/2 to 1-3/4 inches were furnished by Frankford Arsenal for ballistic evaluation. Protection ballistic limits were obtained for a number of obliquity - thickness conditions with caliber .30 AP, ball, and fragment-simulating projectiles, and caliber .50 AP and ball projectiles.

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1. (U) INTRODUCTION

Aluminum armor is not new to Ordnance. Specifications for aluminum of the 2024 type have been in existence for approximately fifteen years. These specifications are for plate of minimum weight whose purpose is to defeat and protect against shell fragments and small-arms projectiles. Unfortunately the 2024 type aluminum does not lend itself to the construction of vehicles because of the welding difficulties encountered when conventional techniques are used. Therefore weldable types of aluminum (5083) which offer good protection against fragments have been selected for the M113 full-tracked personnel carrier. This selection of aluminum over steel armor was to obtain air-transportability for this vehicle.

Ballistic tests have been conducted at several arsenals and at this Proving Ground on aluminum alloy armor which is high in magnesium content. These alloys have been primarily types 5083 and 5456. To supplement existing data Frankford Arsenal requested that ballistic limits be obtained on several thicknesses of type 5083 aluminum armor at four obliquities with several projectiles. The ballistic tests conducted on these plates are the subject of this report.

2. (U) DESCRIPTION OF MATERIAL

2.1 Material

The thirteen aluminum alloy armor plates, type 5083, furnished by Frankford Arsenal were identified as given in Table I.

Table I. Aluminum Alloy Armor Plates Furnished by Frankford Arsenal

<u>Lot Number</u>	<u>Nominal Thickness, inches</u>	<u>Actual Thickness Taken at APG, inches</u>	<u>Size of Plate, inches</u>
198211	1/2	0.530	30 by 30
008711	1/2	.517	18 by 36
008712	1/2	.522	18 by 36
183701	3/4	.794	30 by 30
734-881-1	3/4	.766	18 by 36
734-881-2	3/4	.768	18 by 36
J6293-1	1	1.02	30 by 30
J6293-2	1	a	30 by 30
H6289-4C	1-1/2	1.50	18 by 36
H6288-4A	1-1/2	1.50	18 by 36
H6285-2	1-1/2	a	18 by 36
734-871-2	1-3/4	1.77	18 by 36
734-871-3	1-3/4	a	18 by 36

^aPlates not gaged or used in test.

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2.2 Projectiles:

The projectiles used are listed below:

Projectile, Fragment-Simulating, Caliber .30, weight 44 grains.
hardness 29-31 Rc.
Projectile, Ball, M2, Caliber .30, weight 150 grains.
Projectile, Ball, M2, Caliber .50, weight 703 grains.
Projectile, AP, M2, Caliber .30, weight 164 grains.
Projectile, AP, M2, Caliber .50, weight 710 grains.

2.3 Rifles

The rifles used are listed below:

Rifle, Accuracy, Mann type, Caliber .30, No. 1402245.
Rifle, Accuracy, Mann type, Caliber .30, No. 1512536.
Rifle, Accuracy, .300 Magnum, Caliber .30, No. 44747.
Rifle, Accuracy, Mann type, Caliber .50, No. 22.

3. (CMH) DETAILS OF TEST

3.1 Procedure and Results

The aluminum plates were gaged for thickness prior to firing. Each plate was mounted in a rigid plate butt for testing at the desired angle of obliquity. Attempts were made to obtain one ballistic limit (protection) for each of the conditions listed in Table II.

Table II. Conditions for PBL

<u>Thickness of Plate,</u> <u>inches</u>	<u>Projectile</u>	<u>Obliquity of Fire,</u> <u>degrees</u>			
1/2	Cal .30 Ball	0	30	45	60
1/2	Cal .30 AP, M2	0	30	45	60
1/2	Cal .30 F.S.	0	-	-	-
3/4	Cal .30 Ball	0	30	45	60
3/4	Cal .30 AP, M2	-	-	-	60
3/4	Cal .30 F.S.	0	-	-	-
3/4	Cal .50 Ball	a	a	a	a
3/4	Cal .50 AP, M2	-	30	-	-
1	Cal .30 Ball	0	30	45	60
1	Cal .30 AP, M2	0	30	45	60
1	Cal .50 AP, M2	-	-	-	60

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Table II cont'd

Thickness of Plate, inches	Projectile	Obliquity of Fire, degrees			
1-1/2	Cal .30 Ball	0	30	-	-
1-1/2	Cal .30 AP, M2	-	30	-	-
1-1/2	Cal .50 Ball	a	a	a	a
1-1/2	Cal .50 AP, M2	-	30	-	60
1-3/4	Cal .30 Ball	0	-	-	-
1-3/4	Cal .30 AP, M2	-	30	-	-
1-3/4	Cal .50 Ball	a	a	a	a
1-3/4	Cal .50 AP, M2	-	30	-	-

F.S. = Fragment-Simulating Projectile.

^aThese conditions were to be ballistically evaluated only if limited firings revealed a significant difference between the ballistic limits obtained with Cal .50 Ball, M2 and Cal .50 AP, M2 projectiles.

V₅₀ ballistic limits (protection) were computed throughout the test by averaging the three lowest velocities resulting in complete penetration and the three highest velocities resulting in partial penetration with a velocity spread not exceeding 125 fps for all rounds used in the calculation. Where it was impossible to calculate a ballistic limit without exceeding the 125-fps spread the five lowest velocities resulting in complete penetration and the five highest velocities resulting in partial penetration were averaged to calculate the ballistic limit. No limit was placed on the velocity spread for this ten-round calculation.

The firing procedures and methods for determining partial and complete penetrations under the protection criterion followed those outlined in Ordnance Proof Manual pamphlets 50-30 and 50-10. For the different test conditions the gun-to-plate distances varied and were recorded in the round-by-round data sheets. On all firings with the fragment-simulating projectiles this distance was limited to approximately 30 feet or less to prevent yaw and tumbling of this blunt-nosed projectile.

The round-by-round tabulations of firing data may be found in Appendix C. A summary of the test results is given in Table III.

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Table III. Summary of Test Results

<u>Plate No.</u>	<u>Thickness, inches</u>	<u>Projectile</u>	<u>Obliquity, degree</u>	<u>Ballistic Limit (Protection), fps</u>
<u>Group I (1/2-inch)</u>				
198211	0.530	Cal .30 Ball, M2	0	1564
198211	.530	Cal .30 Ball, M2	30	1903
198211	.530	Cal .30 Ball, M2	45	2173
008711	.517	Cal .30 Ball, M2	60	2715
008712	.522	Cal .30 AP, M2	0	^a 1370
008712	.522	Cal .30 AP, M2	30	1499
008712	.522	Cal .30 AP, M2	45	1731
008711	.517	Cal .30 AP, M2	60 1st	^a 2546
008712	.522	Cal .30 AP, M2	60 2nd	^a 2788
008712	.522	Cal .30 F.S.	0	2382
<u>Group II (3/4-inch)</u>				
734-881 (2)	.768	Cal .30 Ball, M2	0	1711
734-881 (2)	.768	Cal .30 Ball, M2	30	2292
734-881 (2)	.768	Cal .30 Ball, M2	45	2690
183701	.794	Cal .30 Ball, M2	60	3595 HP
734-881 (1)	.766	Cal .30 AP, M2	60	3196
183701	.794	Cal .30 F.S.	0	3493 HP
734-881 (1)	.766	Cal .50 Ball, M2	30	1301
734-881 (1)	.766	Cal .50 AP, M2	30	1367
<u>Group III (1-inch)</u>				
J6293 (1)	1.024	Cal .30 Ball, M2	0	2221
J6293 (1)	1.024	Cal .30 Ball, M2	30	2974
J6293 (1)	1.024	Cal .30 Ball, M2	45	3424
		Cal .30 Ball, M2	60	b
J6293 (1)	1.024	Cal .30 AP, M2	0	1995
J6293 (1)	1.024	Cal .30 AP, M2	30	2222
J6293 (1)	1.024	Cal .30 AP, M2	45	2754
J6293 (1)	1.024	Cal .30 AP, M2	60	3468 HP
J6293 (2)	1.024	Cal .50 AP, M2	60	3104 HP
<u>Group IV (1-1/2 inch)</u>				
H6289-4C	1.497	Cal .30 Ball, M2	0	3398
H6288-4A	1.497	Cal .30 Ball, M2	30	3427 HP
H6289-4C	1.497	Cal .30 AP, M2	30	2668
H6289-4C	1.497	Cal .50 Ball, M2	30	1942
H6288-4A	1.497	Cal .50 Ball, M2	60	2866 HP
H6289-4C	1.497	Cal .50 AP, M2	30	1915
H6288-4A	1.497	Cal .50 AP, M2	60	3116 HP

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Table III cont'd

<u>Plate No.</u>	<u>Thickness, inches</u>	<u>Projectile</u>	<u>Obliquity, degree</u>	<u>Ballistic Limit (Protection), fps</u>
<u>Group V (1-3/4 inch)</u>				
734-871 (2)	1.767	Cal .30 Ball, M2	0	3485 HP
734-871 (2)	1.767	Cal .30 AP, M2	30	2934
734-871 (2)	1.767	Cal .50 Ball, M2	30	2103
734-871 (2)	1.767	Cal .50 AP, M2	30	1969

^aTen-round ballistic limit.

^bCondition not fired - limit of gun reached on a thinner material.

HP - No ballistic limit obtained. High partial penetration (protection) shown.

Two ballistic limits were obtained on the 1/2-inch plates at 60° obliquity with the caliber .30, AP, M2 projectile. Twenty-eight rounds were fired on plate number 008711 and a ten-round limit was estimated to be 2546 fps with a 218-fps spread. Due to the large spread and number of rounds fired, a second limit was attempted on the same plate. Limited area prevented completion of another limit on plate 008711, therefore, a second plate, 008712, was used. The ballistic limit obtained on this plate was 2788 fps (ten-round) with a 217-fps spread.

An attempt was made to obtain a ballistic limit for each projectile obliquity - thickness condition, although the maximum safety level of the gun limited this objective. In several instances the limit of the gun was reached before complete penetrations were obtained. In another instance where no complete penetrations were reached at one obliquity, attempts were not made to determine a ballistic limit at a higher obliquity with the same projectile. It should also be noted that on some of the firings near the maximum limit of the gun the powder charge was not varied as required in the "up and down" method (see OPM 50-30, par. 3.3.2.e), for a ballistic limit which is statistically correct (see Appendix B). This condition could not be prevented without abandoning the test or exceeding the maximum safety level of the weapon. Since the velocities were spread over a 91-fps range without a change in propelling charge it is suspected that the error is small.

Some of the data generated from the firings contained in this report have been presented graphically in Figures 1 through 3.

The test plan described earlier included sample firings with caliber .50 ball ammunition to determine if there would be any difference between these ballistic limits and those taken with caliber .50 AP. Figure 1 indicates that the curves for each projectile follow one another very closely. This firing confirms earlier tests conducted at Frankford Arsenal. Due to the similarity shown in Figure 1 all conditions with caliber .50 ball were not fired.

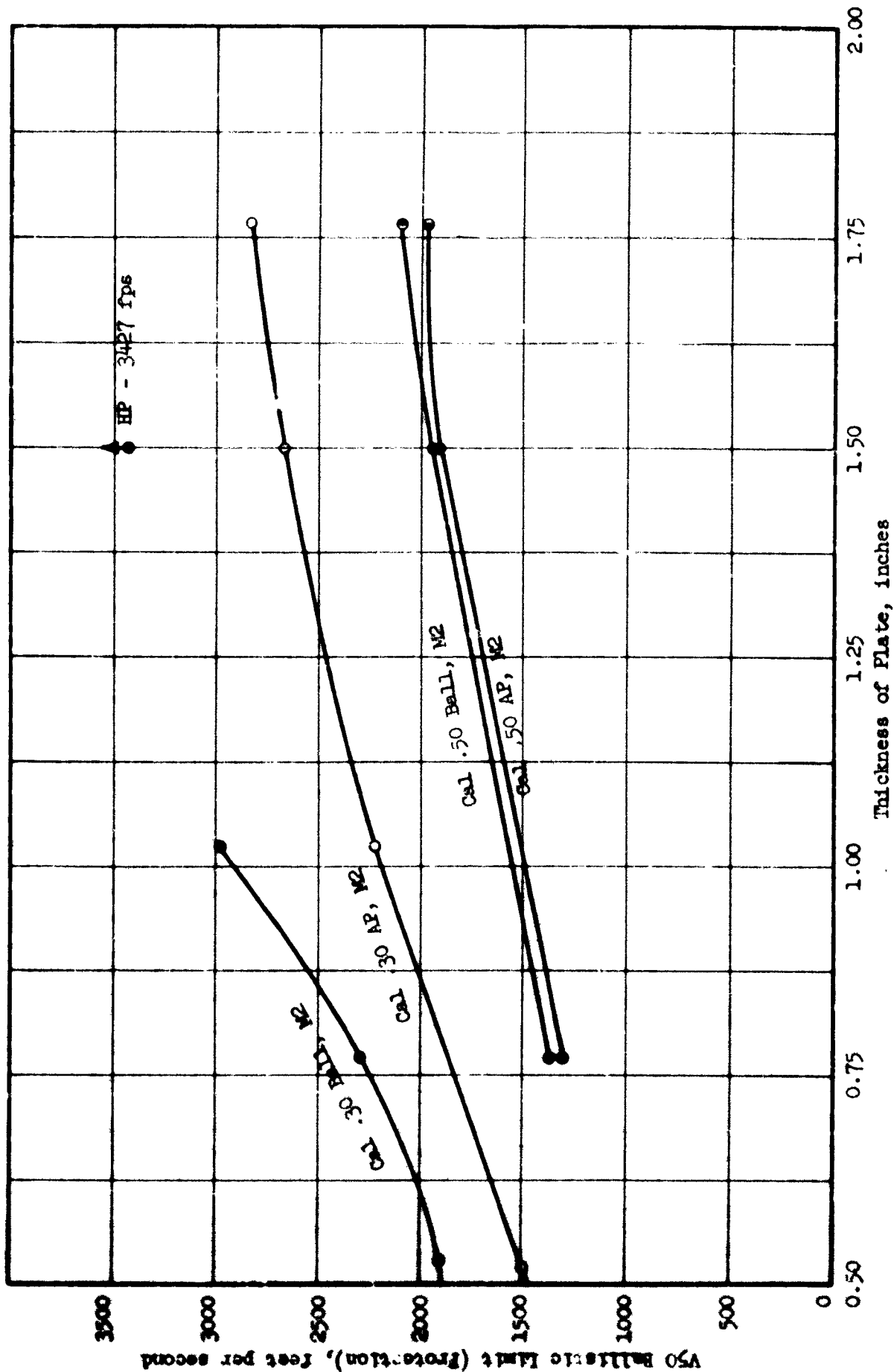


Figure 1: Comparison of Ballistic Limits Obtained on Aluminum (5083) Plate of Varying Thicknesses at 30° Obliquity.

Figure 1

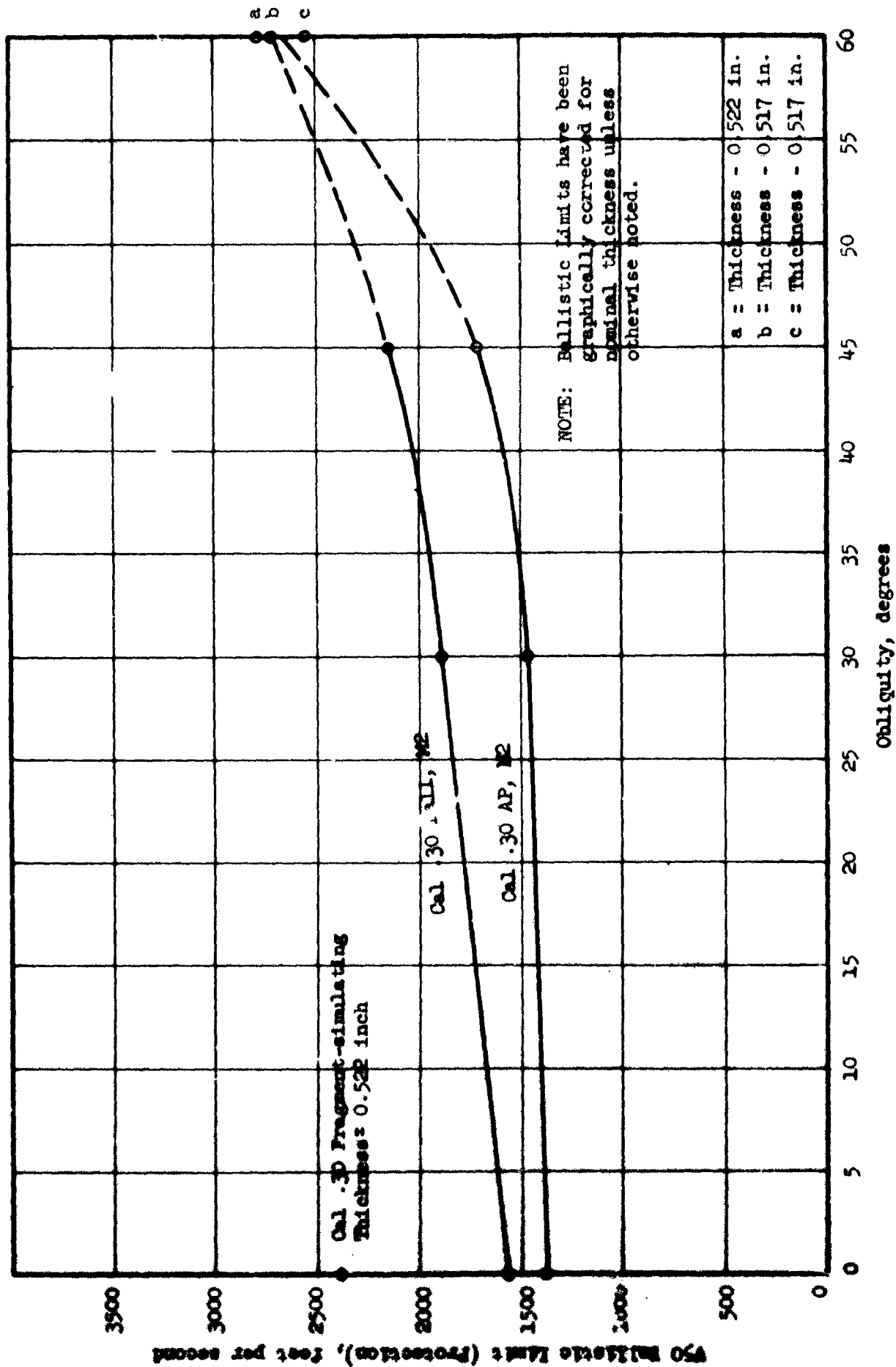


Figure 2: Ballistic Performance of One-Half Inch Aluminum (5083) Plate Against Cal .30 AP, Ball, and Fragment-Simulating Projectiles.

Figure 2

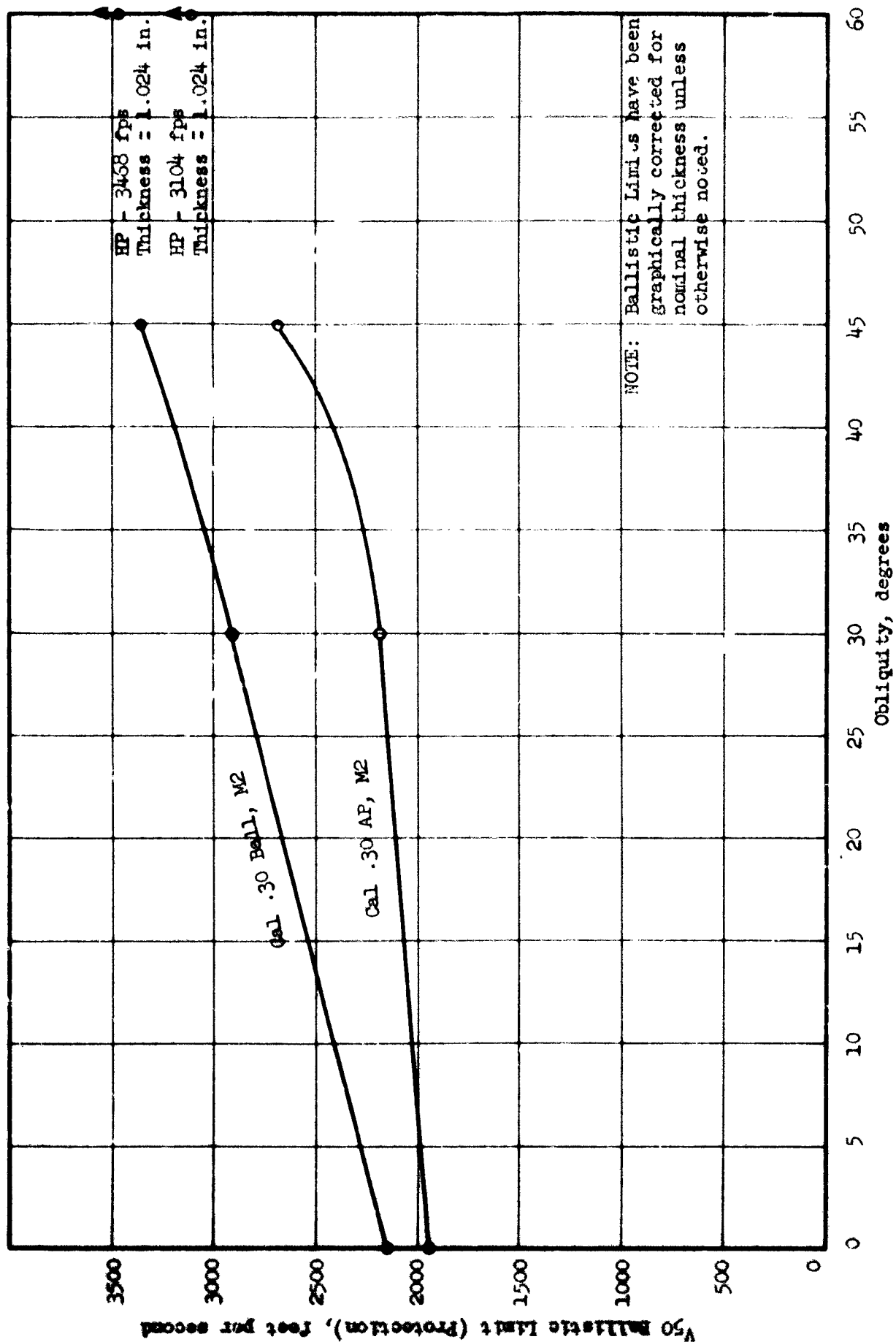


Figure 3: Ballistic Performance of One Inch Aluminum (5083) Plate Against Cal .30 AP and Ball Projectiles.

Figure 3

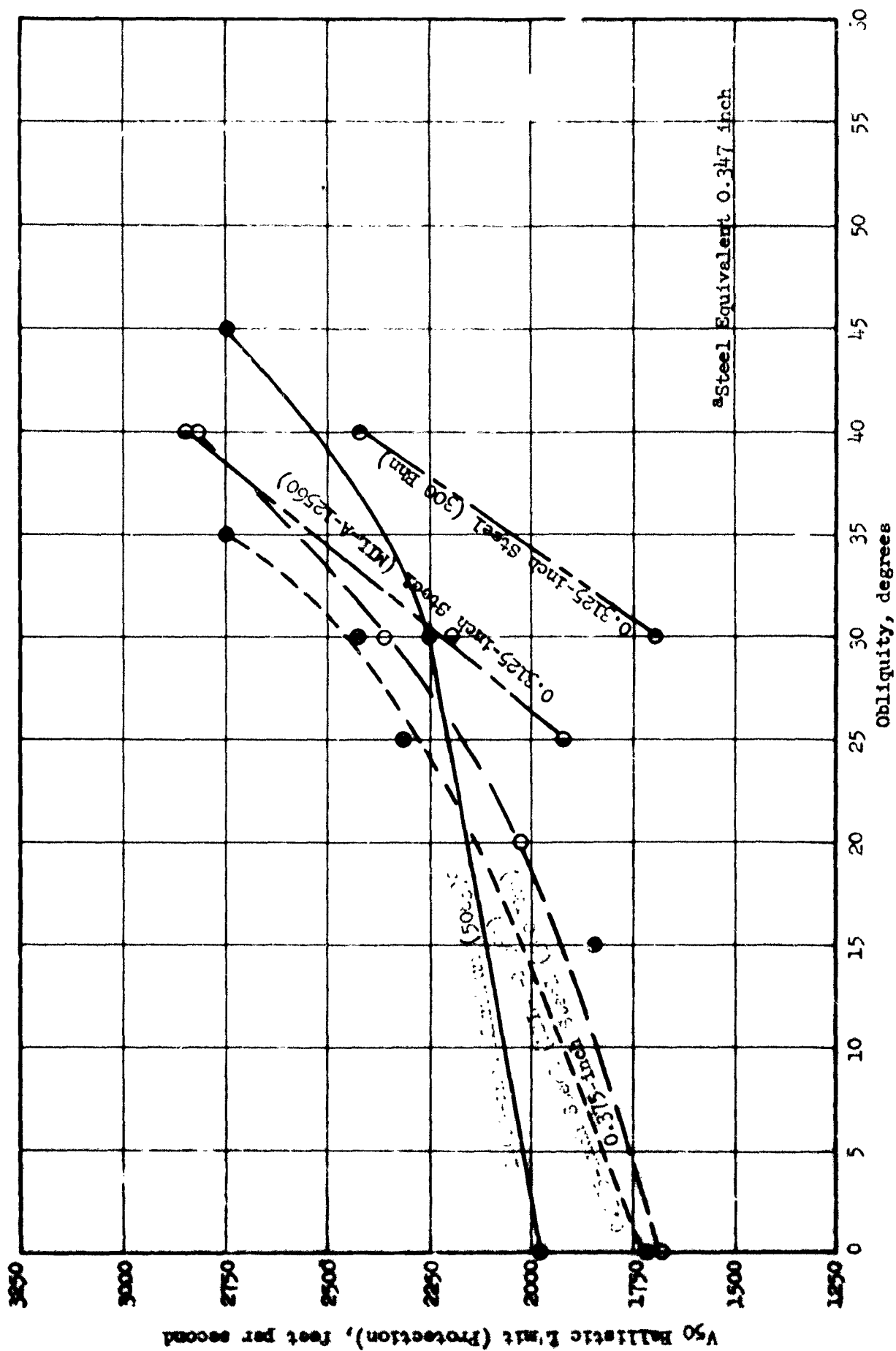


Figure 4: Ballistic Performance of Aluminum Plate (5083) and Steel (MIL-A-12560 and 300 Bhn) Against Caliber .30 AP, M2 Projectiles.

Figure 4

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Figure 4 presents the performance of the aluminum alloy type 5083 with respect to approximate weights of MIL-A-12560 steel (hardness 363-401 Bhn) and 300 Bhn steel armor. The performance of the aluminum armor exceeded that for the steel up to about 25° obliquity. Insufficient data beyond 45° obliquity prevented comparison at the high obliquities. It is realized that aluminum armor primarily is considered as desirable for protection against steel fragments, but the aluminum does give a superior performance to steel at the low obliquities against caliber .30 AP projectiles.

3.2 Observations

In the course of the test it appeared that the aluminum alloy plates used in this test were not homogeneous throughout. There were instances where complete penetrations were obtained on one area of a plate at a given velocity and partial penetrations were obtained on another area at the same or slightly higher velocity. This indicated the aluminum alloy plates might not be homogeneous.

4. (CMH) CONCLUSION

It is concluded from the limited data obtained herein, that the aluminum alloy armor (type 5083) gave a superior performance to an equal weight of steel at obliquities up to 25° when attacked with caliber .30 AP projectiles.

5. (CMH) RECOMMENDATION

Although aluminum alloy armor (type 5083) is considered primarily for steel-fragment protection, ballistic data should be obtained on promising aluminum alloys with small-arms projectiles.

SUBMITTED:

T. J. Griffin
T. J. GRIFFIN
Pfc, Ord Corps
Test Director

REVIEWED:

W. C. Pless
WM. C. PLESS
Chief, Armor Branch

W. A. Gross, Jr.
W. A. GROSS, JR.
Chief, Automotive Division

APPROVED:

H. A. Noble
for H. A. NOBLE
Assistant Deputy Director
for Engineering Testing
Development and Proof Services

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C, DISTRIBUTION	C-1

APPENDIX A
Correspondence

Mr. Kleppinger/mca/7120

OSMA-1320

SUBJECT: Ballistic Tests of Aluminum Plates

TO: Commanding General
Aberdeen Proving Ground
Maryland
ATTN: D & PS, Mr. W. C. Fless

1. In accordance with the telephone conversation on 17 March 1959 between Mr. W. C. Fless of APG and Mr. D. H. Kleppinger of FA, a shipment of aluminum alloy plates will be made to APG within the next week for ballistic testing.

2. The shipment will include the following plates, each plate identifiable by a lot number:

	<u>Number</u>	<u>Size of Plate</u>	<u>Lot Number</u>
1/2" Thickness	1 ea.	30" x 30"	198211
	1 ea.	18" x 36"	008711
	1 ea.	18" x 36"	008712
3/4" Thickness	1 ea.	30" x 30"	183701
	1 ea.	18" x 36"	734-881-1
	1 ea.	18" x 36"	734-881-2
1-1/2" Thickness	1 ea.	18" x 36"	H6285-2
	1 ea.	18" x 36"	H6288-4A
	1 ea.	18" x 36"	H6289-4C
1-3/4" Thickness	1 ea.	18" x 36"	734-871-2
	1 ea.	18" x 36"	734-871-3

3. It is desired that APG personnel test these plates to obtain ballistic limits under conditions of projectile attack as listed in the following tabulation:

OPMA-1520

1. JOT: Ballistic Tests of Aluminum Plates

	<u>Projectile</u>	<u>Obliquity of Fire</u>			
1/2" Plate	Cal. .30 Ball	0°	30°	45°	60°
	Cal. .30 AP F2	0°	30°	45°	60°
	Cal. .30 I.S.	0°	-	-	-
3/4" Plate	Cal. .30 Ball	0°	30°	45°	60°
	Cal. .30 AP F2	-	-	-	60°
	Cal. .30 I.S.	0°	-	-	-
	Cal. .50 Ball	*	*	*	*
	Cal. .50 AP F2	-	30°	-	-
1-1/2" Thickness	Cal. .30 Ball	0°	30°	-	-
	Cal. .30 AP F2	-	30°	-	-
	Cal. .50 AP F2	-	30°	-	60°
	Cal. .50 Ball	*	*	*	*
1-3/4" Thickness	Cal. .30 Ball	0°	-	-	-
	Cal. .30 AP F2	-	30°	-	-
	Cal. .50 AP F2	-	30°	-	-
	Cal. .50 Ball	*	*	*	*

4. It will be noted that in this tabulation, firings of Cal. .50 Ball ammunition have been marked with an asterisk. It is believed from past experience that these projectiles will function essentially as AP ammunition against this target material. It is suggested that "screening" firings be made at high and low obliquity in an attempt to verify this belief. If the ballistic limits of the Cal. .50 Ball are not significantly different from the Cal. .50 AP F2 in these screenings, further firing of the Cal. .50 Ball is not warranted. The decision of whether to continue firing of the Cal. .50 Ball is left to your experience and judgement.

5. Tests of 1-inch plate mentioned in the phone conversation will be made at a later date. One-inch plate on hand at this arsenal is not representative of the quality of plate which can be produced at this time.

6. It is understood that funds for project T4-005 from OAO are available at APO for these firings.

7. In line with the decision reached at OFAC on 4 March, firings of 1-1/4 inch plate using 20mm I.S. at 0° are in progress at this arsenal. These plates will be forwarded to APO in the next two weeks for confirmatory firings.

FOR THE COMMANDER:

R. Mortus
Assistant

ORDNANCE CORPS
FRANKFORD ARSENAL
PHILADELPHIA 37,
PENNSYLVANIA

Mr. Kleppinger/mca/3120

IN REPLY

REFER TO: ORDBA-1320

SUBJECT: Ballistic Tests of Aluminum Plates

TO: Commanding General
Aberdeen Proving Ground
Maryland
ATTN: D & PS, Mr. W. C. Pless

1. In a letter dated 19 March 1959, this arsenal requested APG to ballistically test a group of aluminum alloy plates. Paragraph 5 of that letter indicated that 1 inch plates would be tested at a later date because representative quality plates were not available at that time.

2. Two plates 30" x 30" x 1" of Al-Mg alloy representing material identified by lot number J6293 have been obtained for these tests, and will be shipped to your installation within the next week.

3. It is requested that these plates be tested in accordance with the following firing schedule using available TB4-005 funding.

	<u>Projectile</u>	<u>Obliquity</u>			
1" Plate	Cal. .30 Ball	0°	30°	45°	60°
	Cal. .30 AP42	0°	30°	45°	60°
	Cal. .50 AP42	-	-	-	60°

4. It is requested that fired plates be retained for possible mechanical and metallurgical tests.

FOR THE COMMANDER:

H.P. GEORGE
Assistant

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ROUND-BY-ROUND DATA

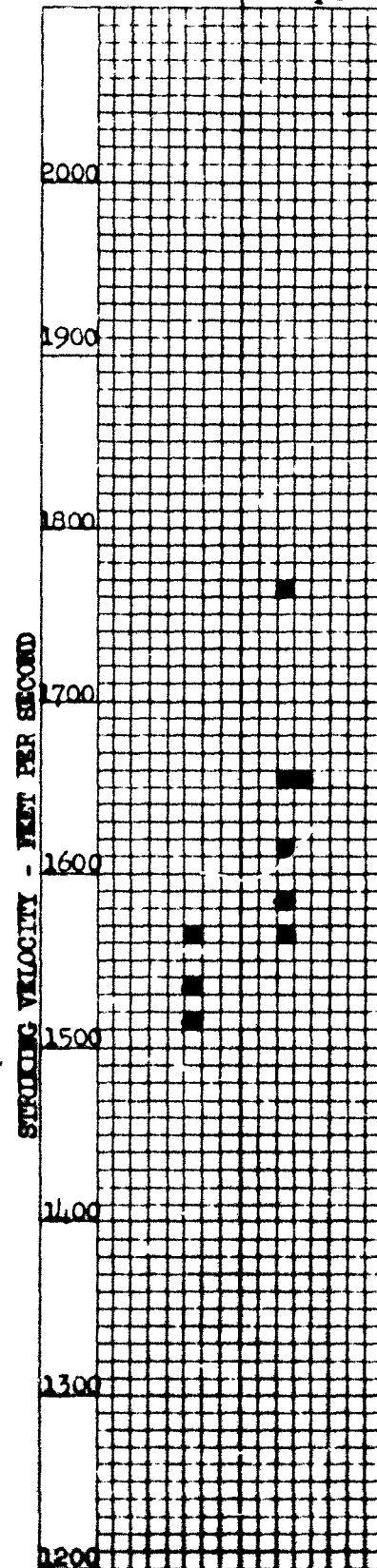
APPENDIX B
Detailed Test Data Sheets
FIRING RECORD NO.

DATE: 2 April 1959

Material: Aluminum	Projectile: Cal .30 Ball 12
Submitted by: Frankford	Gun to 1st Screen: 60.65'
Type of Test: Development	1st Screen to 2d Screen: 49.57'
Size: .530" x 30' x 30"	2d Screen to Plate 182.07'
Plate No. 198211	Obliquity: 0°
Powder: 4759	
Gun No.: 1402215	

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
	Grains	Fps					
1	24	1852	Disr.				
2	24	1682	Disr.				
3	24	1766	CP(P)				
4	23	1653	CP(P)				
5	22	Lost	PP(P)				
6	22	1517*	PP(P)				
7	22	1616*	CP(P)				
8	22	Lost	CP(P)				
9	22	1565*	CP(P)				
10	22	Lost	PP(P)				
11	22	Lost	PP(P)				
12	22	Lost	CP(P)				
13	22	Lost	PP(P)				
14	22	1536*	PP(P)				
15	22	1560*	PP(P)				
16	22	1656	CP(P)				
17	22	1589*	CP(P)				
*V50 Ballistic Limit (Protection) = 1564 fps							
High Partial Penetration = 1560 fps							
Low Complete Penetration = 1565 fps							
Spread = 99 fps							
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B-1

COPY OF APPROVED TESTING RESULTS OF 367

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ROUND-BY-ROUND DATA

FLANK TEST 1010.

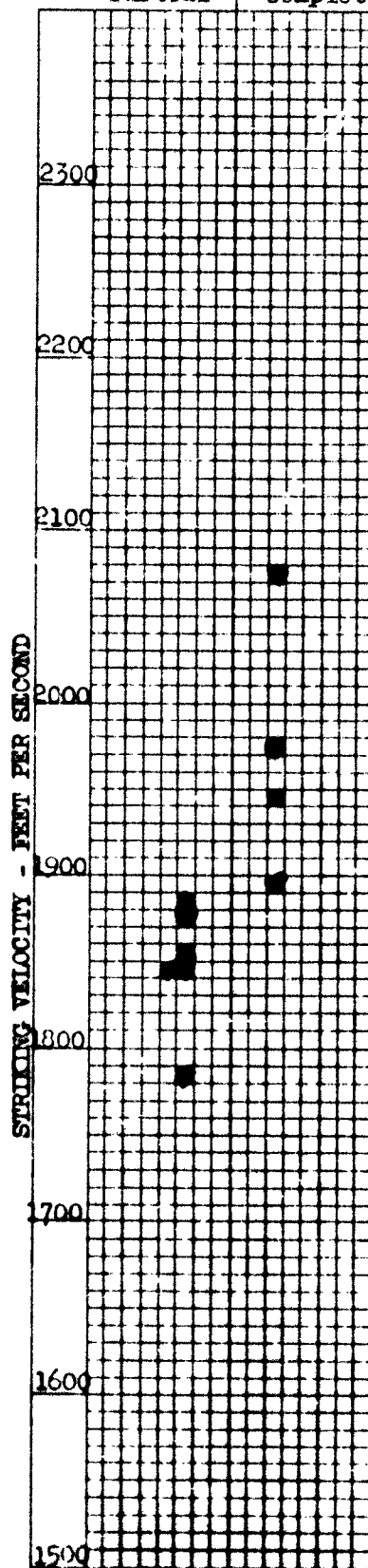
DATE: 2 April 1959

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .530" x 30" x 30"
Plate No. 193211
Total Weight: 193211
Weight of Plate:

Projectile: Cal .30 Ball 12
Gun to 1st Screen: 60.65'
1st Screen to 2d Screen: 49.57'
2d Screen to Plate 183.67'
Obliquity: 30°
Powder: 4759
Gun No.: 140215

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	Grains 30	fps 2072	CP(P)				
2	28	1970*	CP(P)				
3	26	1788	PP(P)				
4	27	1897*	CP(P)				
5	27	1845	PP(P)				
6	27	1844	PP(P)				
7	27	1899	Disr.				
8	27	1870*	PP(P)				
9	27 +	1850*	PP(P)				
10	27	1885*	PP(P)				
11	28	1935	Disr.				
12	28	1943*	CP(P)				
*V50 Ballistic Limit (Protection) = 1903 fps							
High Partial Penetration = 1885 fps							
Low Complete Penetration = 1897 fps							
Spread = 120 fps							
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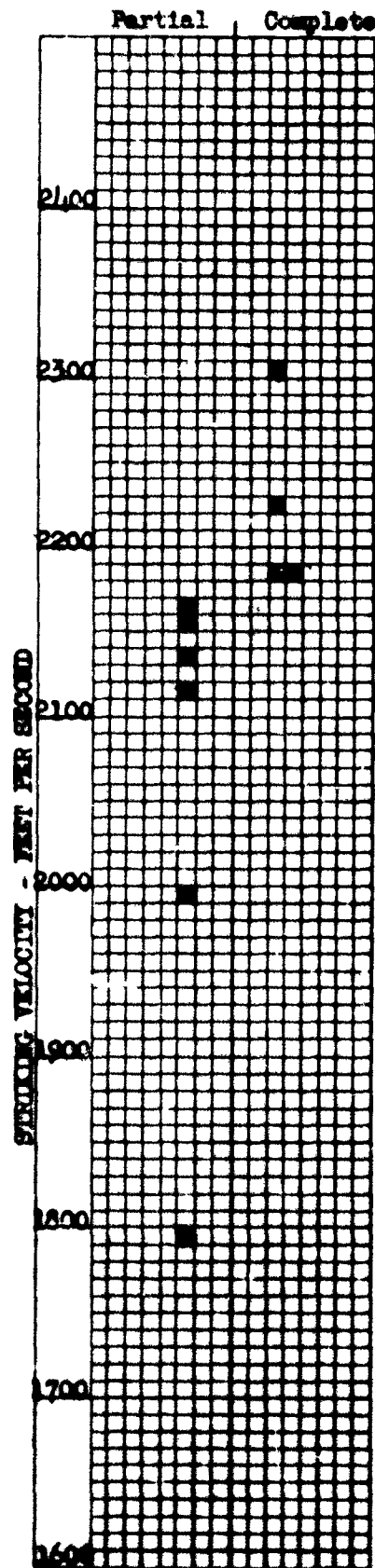
FIRING RECORD NO.

DATE: 1 April 1959

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .530" x 30" x 30"
Plate No. 198211
Gun No.: 44747

Projectile: Cal .30 Ball M2
Gun to 1st Screen: 60.65'
1st Screen to 2d Screen: 49.57'
2d Screen to Plate: 188.46'
Obliquity: 45°
Powder: 4759
Gun No.: 44747

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	25	1791	PP(P)				
2	30	1997	PP(P)				
3	34	2300	CP(P)				
4	32	Lost	CP(P)				
5	32	2166*	PP(P)				
6	32	Lost	PP(P)				
7	32	Lost	CP(P)				
8	32	Lost	CP(P)				
9	32	2181*	CP(P)				
10	32	2136*	PP(P)				
11	32	2113	PP(P)				
12	32 +	2221*	CP(P)				
13	32 +	2151*	PP(P)				
14	32 +	2185*	CP(P)				
*V50 Ballistic Limit (Protection) = 2173 fps							
High Partial Penetration = 2166 fps							
Low Complete Penetration = 2188 fps							
Spread = 85 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							

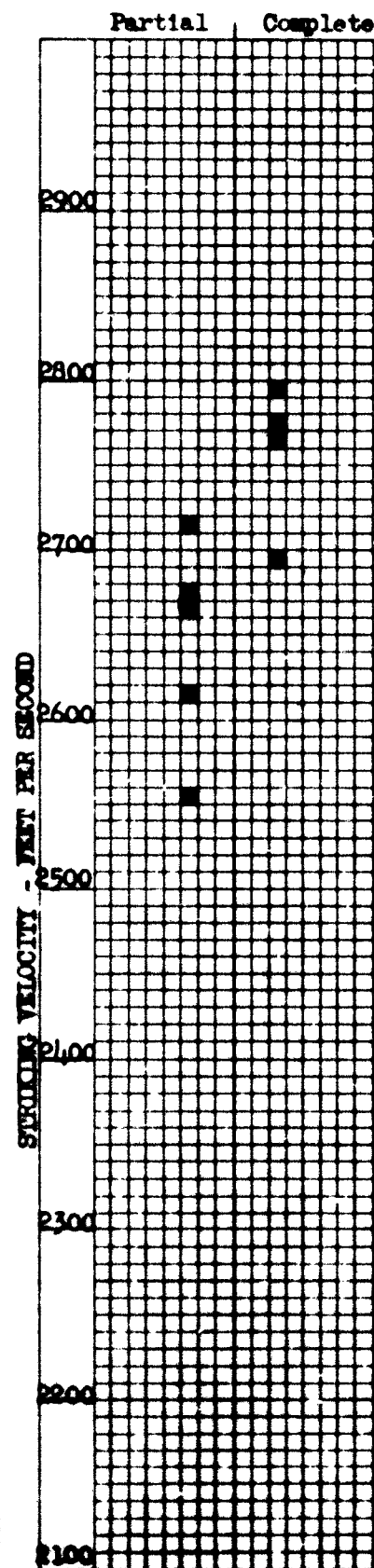


庚子年 2
7 月 4 日

FIRING RECORD NO.

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .517" x 18" x 36"
Reference Plate No.
Stock Identification 008711
Manufacturing Date

Projectile: Cal .30 Ball M2
 Gun to 1st Screen: 60.65'
 1st Screen to 2d Screen: 19.45'
 2d Screen to Plate 188.46'
 Obliquity: 60°
 Powder: 24664
 Gun No.: 44747

[illegible]

▲▲▲▲▲

8-4

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

~~ROUND-BY-ROUND AUTHORIZED~~

DATE: 31 March 1959

Projectile: Cal .30 AP M2
Gun to 1st Screen: 23.83'
1st Screen to 2d Screen: 32.62'
2d Screen to Plate 235.83'
Obliquity: 0°
Powder: 4759
Gun No.: 1402245

Stroking Velocity (Feet per Second)	Partial	Complete
1100	1250	
1250	1250, 1330, 1470	1410, 1470
1330	1250, 1330	1410, 1470
1470	1250, 1330, 1470	1410, 1470

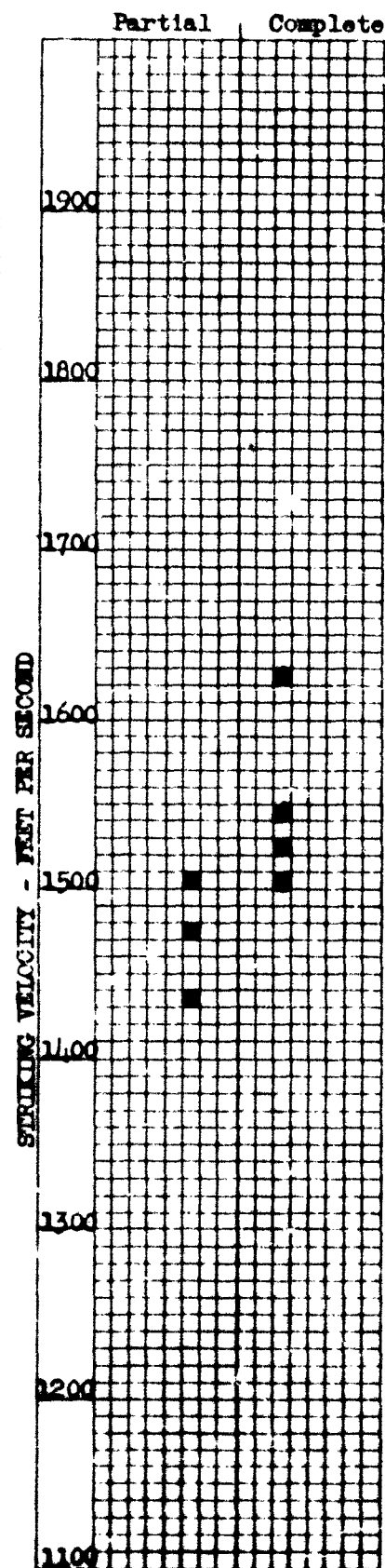
[illegible]

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

MODIFIED BY AUTHORIZED

DATE: 31 March 1959

Projectile: Cal .30 AP M2
Gun to 1st Screen: 25.83'
1st Screen to 2d Screen: 32.62'
2d Screen to Plate 237.43'
Obliquity: 30°
Powder: 4759
Gun No.: 1102245

[illegible]

名称: 400 电话: 010-63001111 地址: 北京市西城区西便门大街 2 号 邮编: 100031
 网址: <http://www.12315.gov.cn>

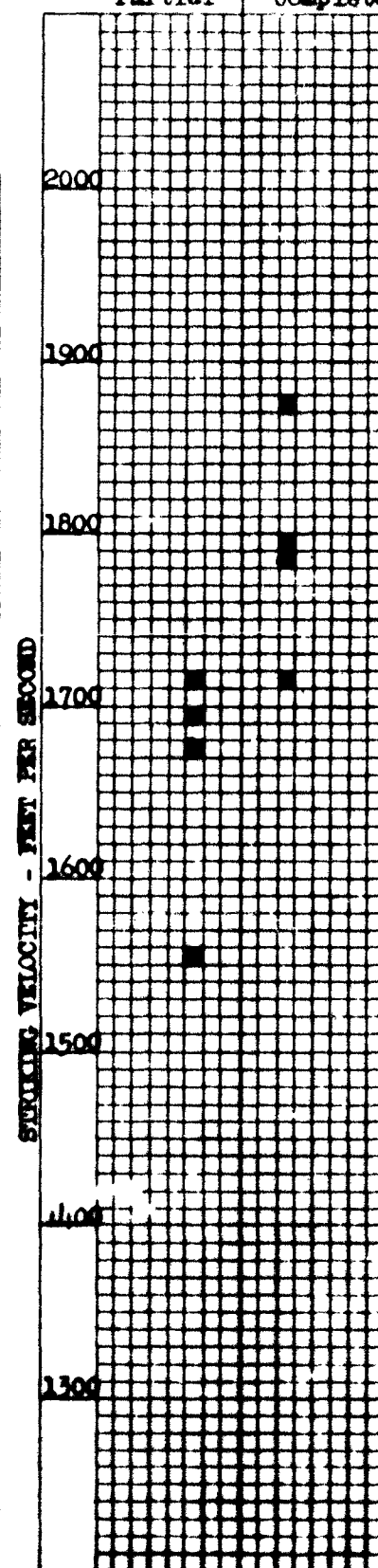
RECEIVED
2000

FILING RECORD NO.

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .522" x 18" x 36"
Situation Plate No.
008712

Projectile: Cal .30 AP M2
Gun to 1st Screen: 23.83'
1st Screen to 2d Screen: 32.62'
2d Screen to Plate 240.48'
Obliquity: 45°
Powder: 4759
Gun No.: 1402215

Partial Complete

[illegible]

2025 RELEASE UNDER E.O. 14176

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

2 D. 41

FIRING RECORD NO.

Material: Aluminum
Submitted by: Frankford Ars.
Type of Test: Development
Size: .517" x 18" x 36"
Plum Pl. No.
Total Weight: 008711
Weight of Lot:

Projectile: Cal .30 AP, M2
Gun to 1st Screen: 23.83'
1st Screen to 2d Screen: 32.62'
2d Screen to Plate 242.23'
Obliquity: 60°
Powder: 4759 - 24664
Gun No.: 1102245 - 44747

A scatter plot showing the relationship between Stopping Velocity (ft/sec) and Stopping Distance (ft) for two conditions: Partial Stopping and Complete Stopping. The y-axis ranges from 2000 to 2800 ft/sec, and the x-axis ranges from 0 to 100 ft. Data points are represented by solid black squares. For Partial Stopping, there are 10 data points. For Complete Stopping, there are 10 data points.

Stopping Distance (ft)	Stopping Velocity (ft/sec) - Partial	Stopping Velocity (ft/sec) - Complete
10	2000	2000
20	2190	2190
30	2270	2270
40	2420	2420
50	2460	2460
60	2570	2570
70	2570	2570
80	2650	2650
90	2650	2650
100	2740	2740

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ROUND-BY-ROUND DATA

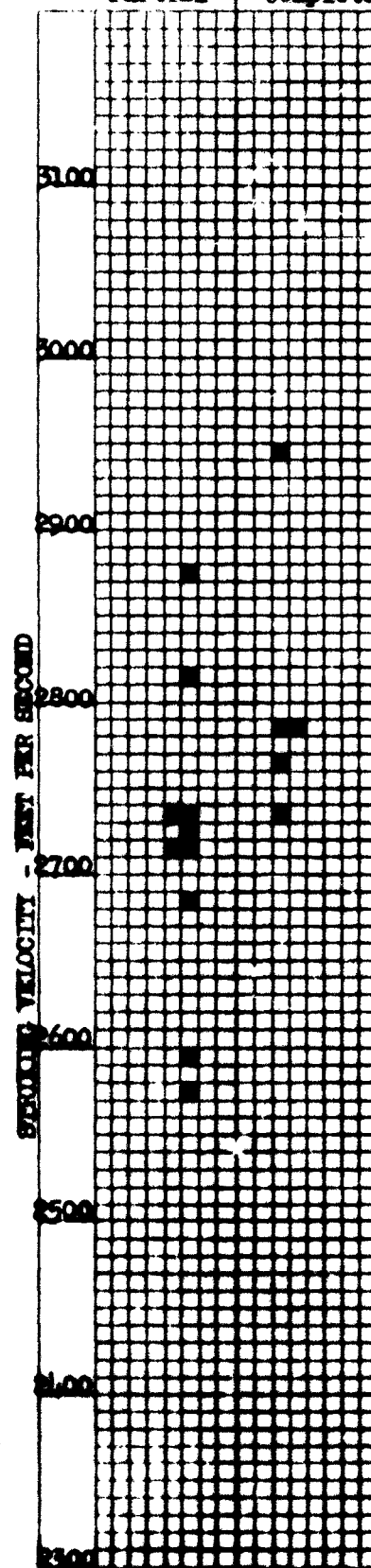
FILED RECORD NO.

DATE: 24 April 1959

Material: Aluminum
Submitted by: Frankford Arsenal
Type of Test: Development
Size: .522" x 18" x 3/8"
EPRM: Pl. No.
Technical Drawing: 008712
Master Drawing: 1000

Projectile: Cal .30 AP, M2
Gun to 1st Screen: 8.07'
1st Screen to 2d Screen: 11.92'
2d Screen to Plate 16.35'
Obliquity: 60°
Powder: 24.664
Gun No.: 44747

Partial , Complete

[illegible]

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ROUND-BY-ROUND DATA

DATE: 13 April 1959

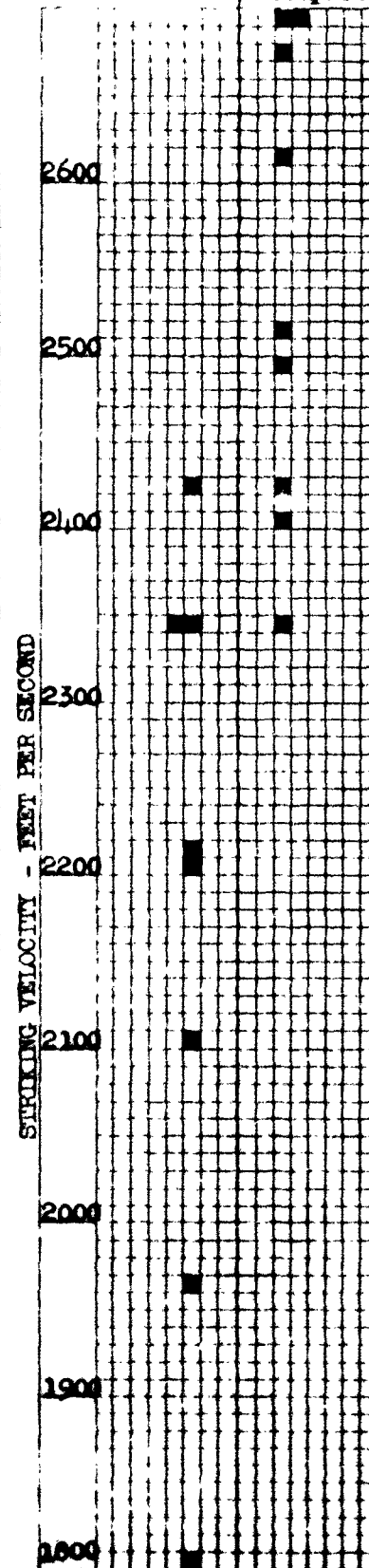
Material: Aluminum
Submitted by: Frankford Ars.
Type of Test: Development
Size: .522"x18"x36"
Pl. No. 008712
008712

Projectile: Cal .30 Fragment-Simulating
Gun to 1st Screen: 11.66'
1st Screen to 2d Screen: 10.02'
2d Screen to Plate 9.00'
Obliquity: 0°
Powder: 4759
Gun No.: 1402245

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	Grains 40	3465	CP(P)	17	Grains 22	2409*	CP(P)
2	30	3037	CP(P)	18	22	2378	Dis.
3	25	2678	CP(P)	19	22	2427*	CP(P)
4	20	1967	PP(P)				
5	22	2611	CP(P)				
6	20	2214	PP(P)				
7	21	2427*	PP(P)				
8	21	2343*	CP(P)				
9	21	2204	PP(P)				
10	21	2109	PP(P)				
11	22	2492	CP(P)				
12	22 -	2513	CP(P)				
13	21 -	1551	PP(P)				
14	21	2214	Dis.				
15	22 -	2343*	PP(P)				
16	22 -	2343*	PP(P)				

*V50 Ballistic Limit (Protection) = 2382 fps
High Partial Penetration = 2427 fps
Low Complete Penetration = 2343 fps
Spread = 84 fps



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CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

ROUND-BY-ROUND DATA

FLYING RECORD

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .768" x 18" x 36"

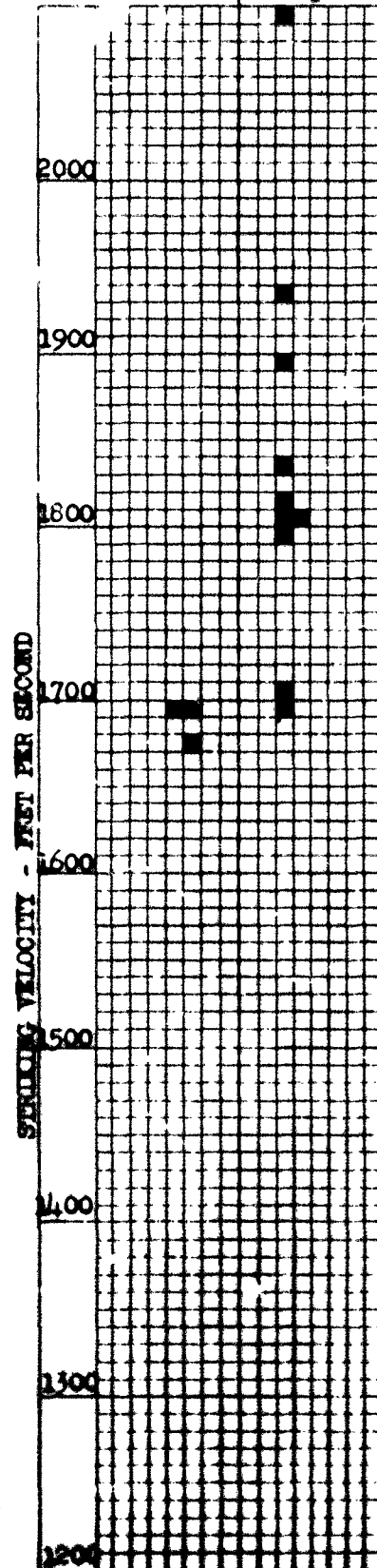
Projectile: Cal .30 Ball M2
Gun to 1st Screen: 60.65'
1st Screen to 2d Screen: 49.57'
2d Screen to Plate: 182.07'
Obliquity: 0°
Powder: 4759
Gun No.: 1402245

DATE: 2 April 1959

Pl. No.
734-881(2)

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	30	2103	CP(P)				
2	27	1933	CP(P)				
3	25	1677*	PP(P)				
4	26	1799	Diar.				
5	26	1808	CP(P)				
6	25 +	1899	CP(P)				
7	25 +	1814	CP(P)				
8	26	1830	CP(P)				
9	25	1807	CP(P)				
10	25	1694*	PP(P)				
11	25	1799*	CP(P)				
12	25	1699*	CP(P)				
13	25	1681	Diar.				
14	25	Lost	CP(P)				
15	25	1701*	CP(P)				
16	25	1694*	PP(P)				
*V50 Ballistic Limit (Protection) = 1711 fps							
High Partial Penetration = 1694 fps							
Low Complete Penetration = 1699 fps							
Spread = 122 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							



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ROUND-BY-ROUND DATA

FIRING RECORD

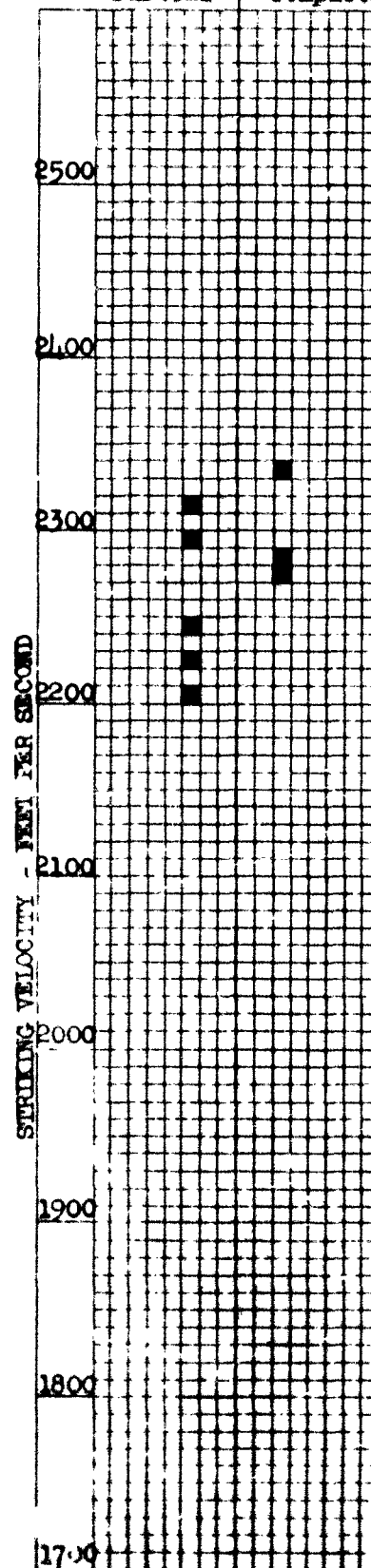
Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .768"x18"x36"
Pl. No. 734-881(2)
Weight: 11.02245

Projectile: Cal..30 Ball M2
Gun to 1st Screen: 60.65'
1st Screen to 2d Screen: 49.57'
2d Screen to Plate 183.67'
Obliquity: 30°
Powder: 4759
Gun No.: 1402245

DATE: 2 April 1959

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	30	Lost	PP(P)				
2	32	Lost	PP(P)				
3	34	Lost	CP(P)				
4	34	Lost	CP(P)				
5	34	2324	Disr.				
6	33	2222	PP(P)				
7	34	2338*	CP(P)				
8	34	2202	PP(P)				
9	34	2248*	PP(P)				
10	34	2287	Disr.				
11	34	2292*	PP(P)				
12	34 +	2275*	CP(P)				
13	34 +	2313*	PP(P)				
14	34 +	2285*	CP(P)				
*V50 Ballistic Limit (Protection = 2292 fps							
High Partial Penetration = 2313 fps							
Low Complete Penetration = 2275 fps							
Spread = 90 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							



RECEIVED 10 Nov 1964

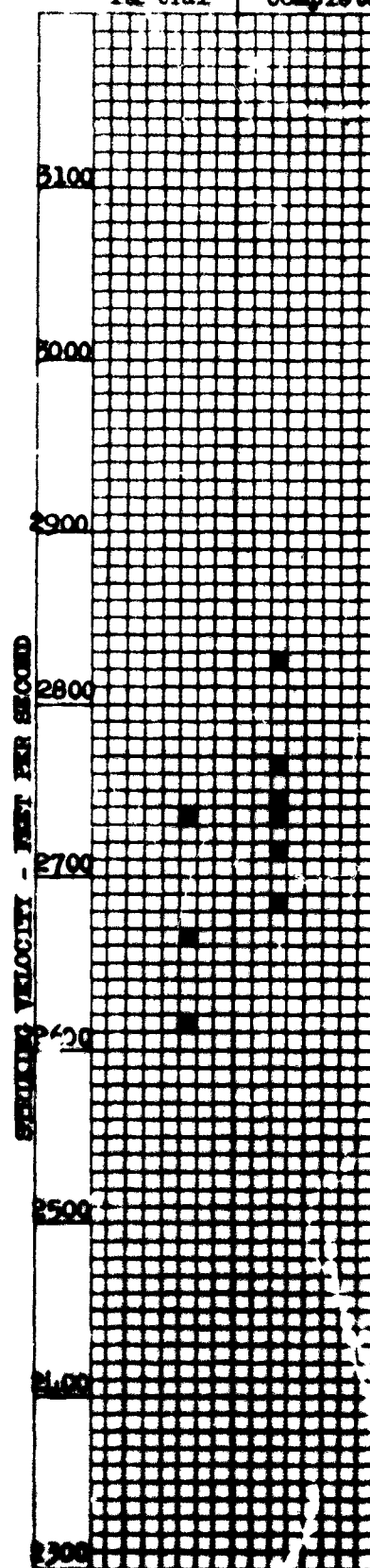
FIRING RECORD NO.

Projectile: Cal .30 Ball, M2
Gun to 1st Screen: 60.65'
1st Screen to 2d Screen: 49.57'
2d Screen to Plate 187.07'
Obliquity: 45°
Powder: 4759 - 24664
Gun No.: 1402245 - 44747

DATE: 3 April 1959

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	CP(R) 40	fps 2614*	PP(P)				
CHANGED GUN TO 300 MAGNUM NO. 44747							
2	62	2822	CP(P)				
3	60	2666*	PP(P)				
4	61	2683*	CP(P)				
5	61	2730*	PP(P)				
6	61	2736*	CP(P)				
7	61	2748	CP(P)				
8	61	2760	CP(P)				
9	60	2713*	CP(P)				
*V50 Ballistic Limit (Protection) = 2690 fps High Partial Penetration = 2730 fps Low Complete Penetration = 2683 fps Spread = 122 in							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							



B-13

2025 RELEASE UNDER E.O. 14176

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

ROUND-BY-ROUND DATA

DATE: 3 April 1959

Projectile: Cal .30 Ball, M2
Gun to 1st Screen: 60.65' 11.53'
1st Screen to 2d Screen: 49.57' - 10.04'
2d Screen to Plate 188.46' - 15.70'
Obliquity: 60°
Powder: 24664
Gun No.: 44747

Partial Complete

[illegible]

Stocking Velocity - Feet Per Second

Stocking Velocity (Feet Per Second)	Stocking Velocity (Feet Per Second)
3100	3100
3350	3350
3550	3550
3600	3600

0.24

● 2014 年 12 月 1 日起, 将《中华人民共和国企业所得税法》第二十八条第二款修改为: “国家需要重点扶持的高新技术企业, 减按 15% 的税率征收企业所得税。”

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

OSDAG-1203 (Rev.)
2 Dec 51

MODIFIED HANDLING AUTHORIZED

FIRING RECORD NO.

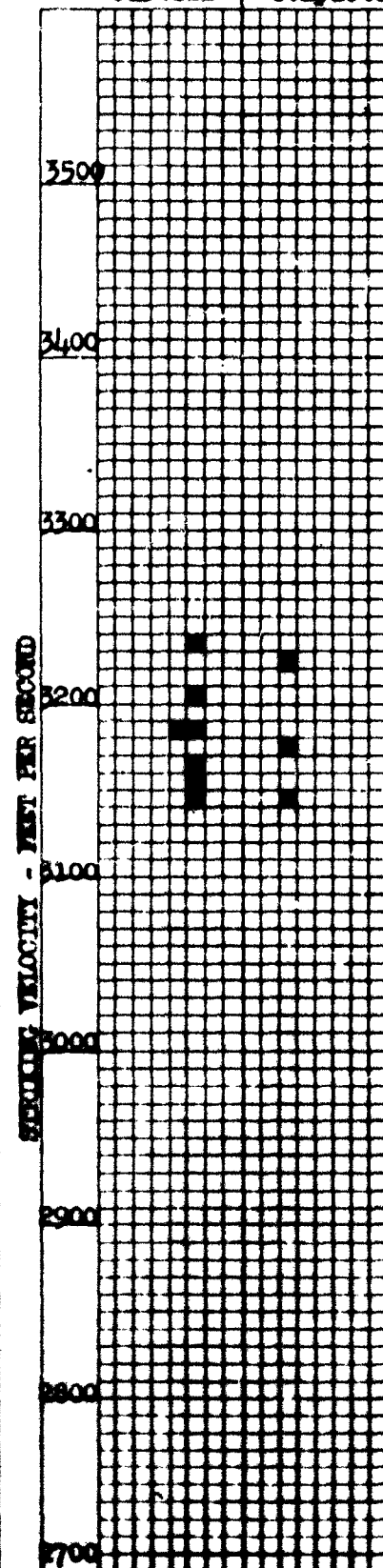
DATE: 3 April 1959

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .766" x 18" x 36"
Plate No. 734-881(1)
Weight: 2.11

Projectile: Cal .30 AP M2
Gun to 1st Screen: 60.65'
1st Screen to 2d Screen: 49.57'
2d Screen to Plate: 188.46'
Obliquity: 60°
Powder: 24664
Gun No.: 44747

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	70	Lost	Dis.				
2	70	3219	Dis.				
3	70	3203	PP(P)				
4	70	3175*	CP(P)				
5	70	3142*	CP(P)				
6	70	3146	PP(P)				
7	70	3168	PP(P)				
8	70	3152	PP(P)				
9	70 +	3181	PP(P)				
10	70 +	3189*	PP(P)				
11	70 +	3233*	PP(P)				
12	70 +	3218*	PP(P)				
13	70 +	3224*	CP(P)				
*V50 Ballistic Limit (Protection) = 3196 fps							
High Partial Penetration = 3233 fps							
Low Complete Penetration = 3142 fps							
Spread = 91 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							

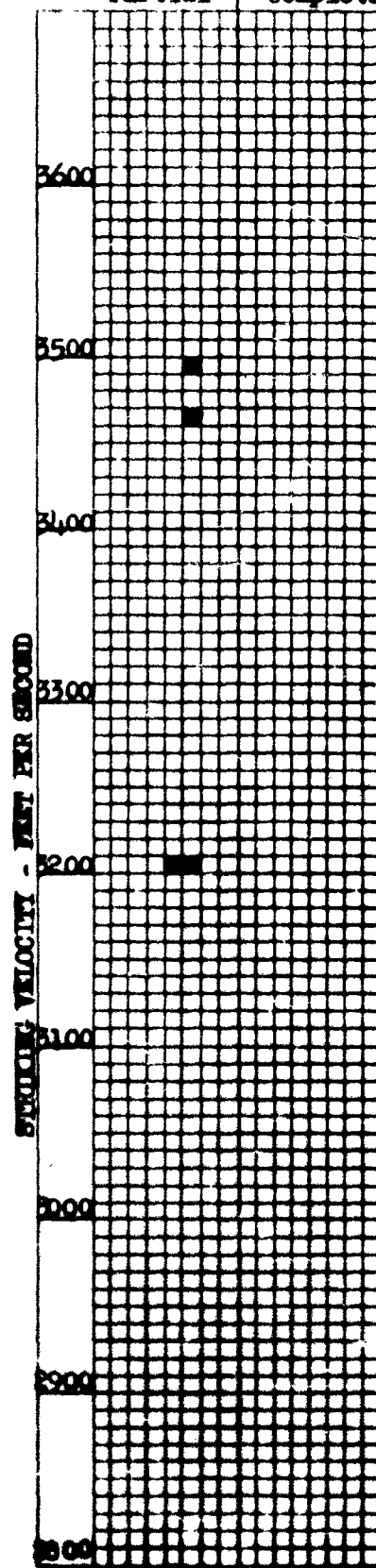


ROUND-BY-ROUND DATA
MODIFIED BY AUTHORIZED

DATE: 10 April 1959

Projectile: Cal .30 Fragment-Simulating
Gun to 1st Screen: 11.65'
1st Screen to 2d Screen: 10.03'
2d Screen to Plate 8.93'
Obliquity: 0°
Powder: 4759 - 24664
Gun No.: 1402245 - 44747

Partial , Complete

[illegible][illegible]

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1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 26

FIRING RECORD NO.

Projectile: Cal .50 AP M2
Gun to 1st Screen: 60.63'
1st Screen to 2d Screen: 49.71'
2d Screen to Plate 183.29'
Obliquity: 30°
Powder: 35683
Gun No.: 22

DATE: 7 April 1959

Dose (mg/m²)	Partial Responses	Complete Responses
0.5	0	0
1.0	0	0
2.0	0	0
3.0	0	0
4.0	0	0
5.0	0	0
6.0	0	0
8.0	~1200	0
10.0	~1300	0
12.0	~1300	~1300
16.0	~1500	~1500

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MODIFIED HANDLING AUTHORIZED

FIRING RECORD NO.

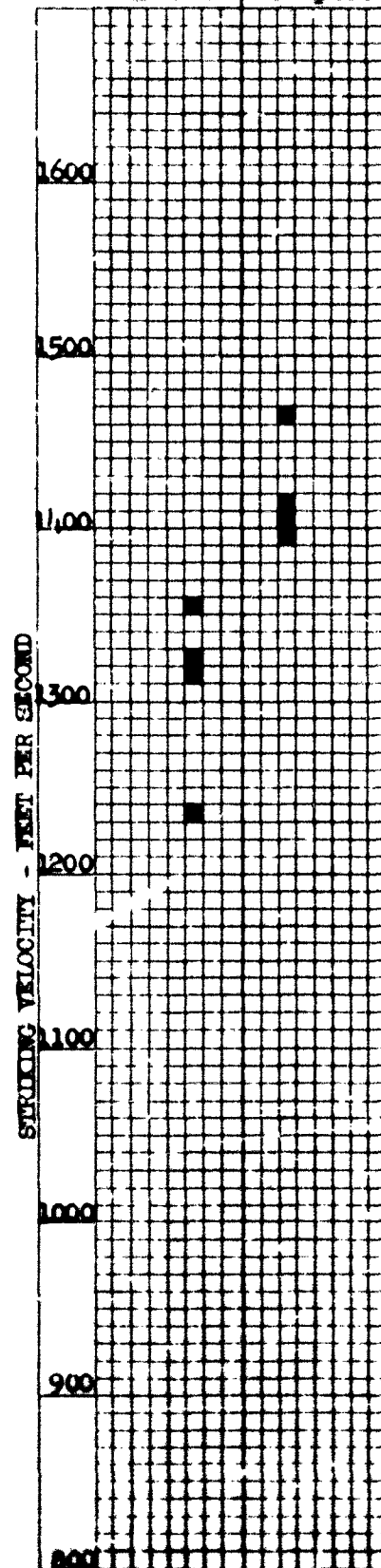
Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: .766" x 18" x 36"
~~Shot~~ Plate No.
~~Shot~~ 734-881(1)
~~Shot~~

Projectile: Cal .50 Ball M2
Gun to 1st Screen: 60.63'
1st Screen to 2d Screen: 49.71'
2d Screen to Plate 183.29'
Obliquity: 30°
Powder: 35683
Gun No.: 22

DATE: 7 April 1959

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	100	1603	Disr.				
2	90	1461	CP(P)				
3	70	1234	Disr.				
4	70	1236	PP(P)				
5	80	Lost	PP(P)				
6	80	1340	Disr.				
7	80	1316*	PP(P)				
8	85	1404	Disr.				
9	85	1351*	PP(P)				
10	88	1410*	CP(P)				
11	85	1407*	CP(P)				
12	83	1392*	CP(P)				
13	80	1326*	PP(P)				
*V50 Ballistic Limit (Penetration) = 1367 fps							
High Partial Penetration = 1351 fps							
Low Complete Penetration = 1392 fps							
Spread = 94 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							



CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

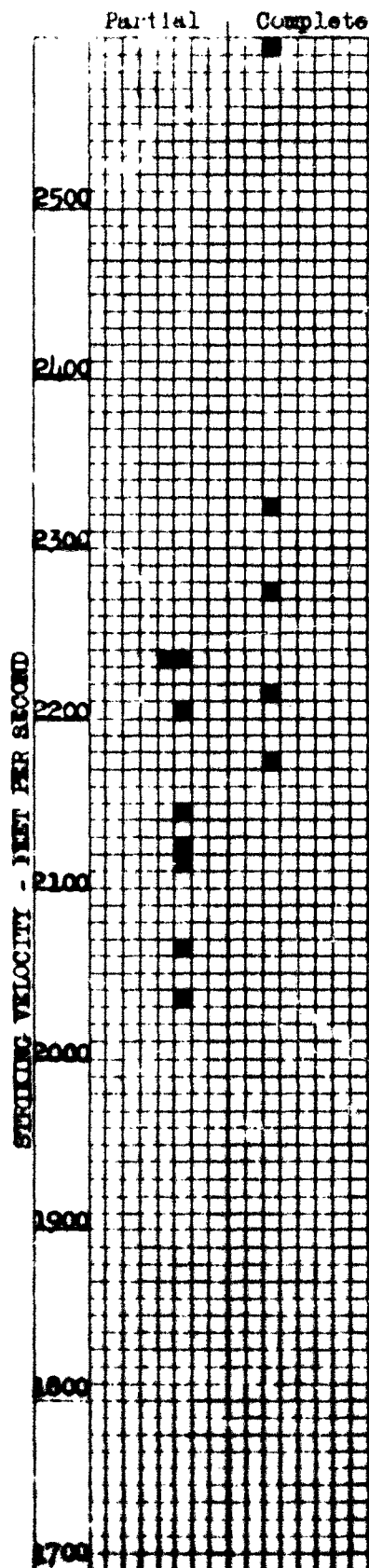
CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

ROUND-BY-ROUND DATA

DATE: 14 April 1959

Material: Aluminum
 Submitted by: Frankford Ars.
 Type of Test: Development
 Size: 1.024" x 30" x 30"
 Pl. No. 6293 Pl #1
 Projectile: Cal .30 Ball M2
 Gun to 1st Screen: 11.68'
 1st Screen to 2d Screen: 10.04'
 2d Screen to Plate 8.94'
 Obliquity: 0°
 Powder: 4759
 Gun No.: 1512536

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	31	2204	CP(P)				
2	31	2329	CP(P)				
3	28	2215*	CP(P)				
4	26	2176*	CP(P)				
5	24	2034	PP(P)				
6	25	2063	PP(P)				
7	26	2116	PP(P)				
8	26 +	2125	PP(P)				
9	27	2114	PP(P)				
10	28	2205*	PP(P)				
11	28 +	2230*	PP(P)				
12	29	2271*	OP(P)				
13	29	2230*	PP(P)				
*V50 Ballistic Limit (Protection = 2221 fps							
High Partial Penetration = 2230 fps							
Low Complete Penetration = 2176 fps							
Spread = 25 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							



CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

ROUND-BY-ROUND DATA

FIG. 10 RECORD D.

Material: Aluminum
Submitted by: Frankford Ars.
Type of Test: Development
Size: 1.024" x 30" x 30"
Pl. No. 6293 Pl. #1
Gun No.: 1512536 - 44747

Projectile: Cal .30 Ball, M2
Gun to 1st Screen: 11.68' 7.95'
1st Screen to 2d Screen: 10.04' 12.00'
2d Screen to Plate 10.34' 10.65'
Obliquity: 30°
Powder: 4759 - 24664
Gun No.: 1512536 - 44747

DATE: 14 April 19
16 April 19

Partial Complete

Rd No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
1	32	2419	PP(P)				
2	35	2556	PP(P)				
3	40	2816	PP(P)				
CHANGED GUN, .300 MAGNUM NO. 44747							
4	70	3196	CP(P)				
5	62	3048	CP(P)				
6	57	2837	Dis.				
7	59	2980*	CP(P)				
8	57	2865	PP(P)				
9	58	2879	PP(P)				
10	59	2914*	PP(P)				
11	60	3025*	CP(P)				
12	59	2950*	PP(P)				
13	59	2980*	PP(P)				
14	59 +	2995*	CP(P)				
50 Ballistic Limit (Protection) = 2974 fps High Partial Penetration = 2980 fps Low Complete Penetration = 2980 fps Spread = 111 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							

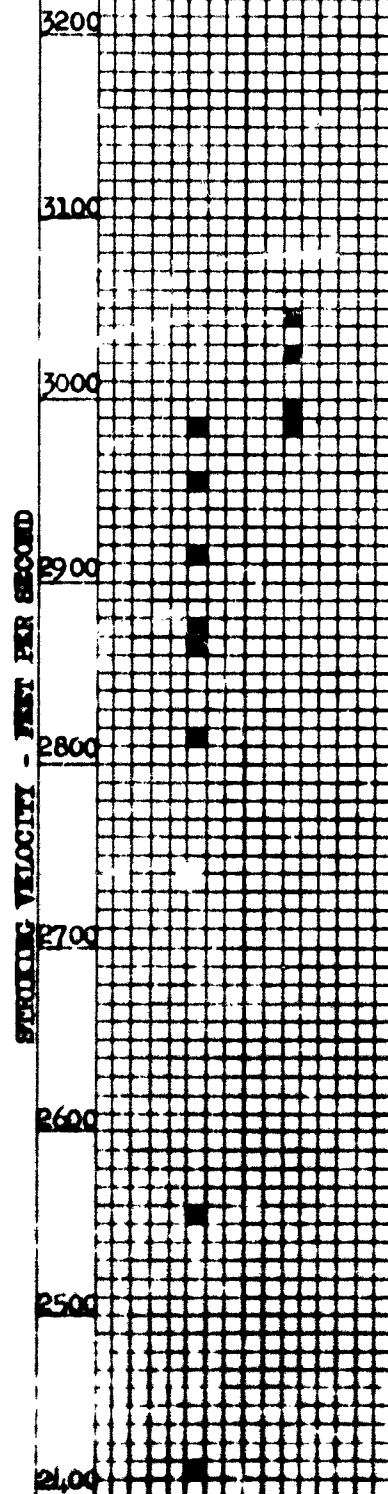


FIGURE 15-10-1.

DATE: 15 April 1959

Material: Aluminum

Projectiles: Cal .30 Ball, M2

Submitted by: Frankford Ars.

Gun to 1st Screen: 11.68'

Type of Test: Development

1st Screen to 2d Screen: 10.04'

Size: 1.024" x 30" x 30"

2d Screen to Plate 13.74'

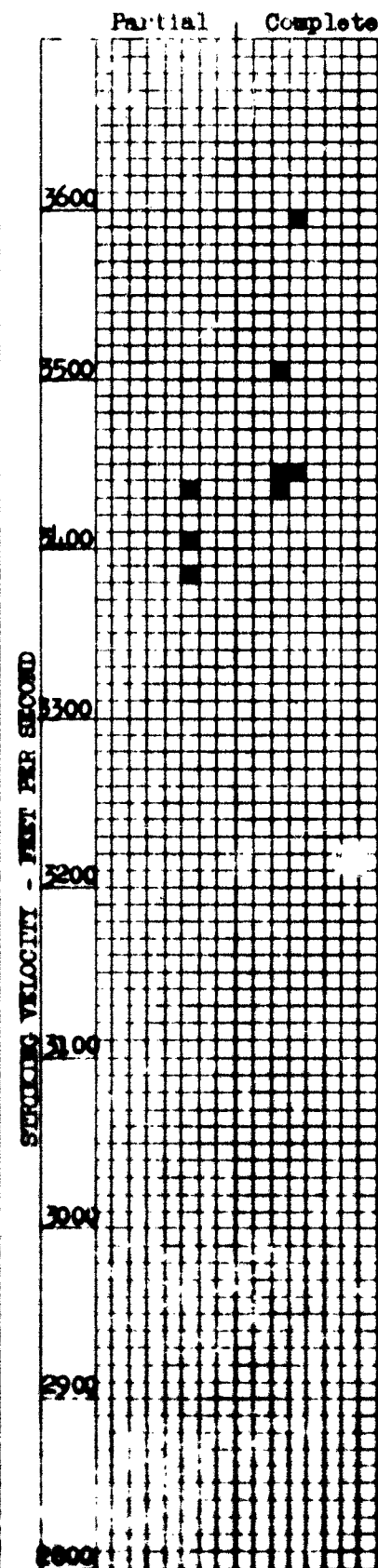
Pl. No.

Obliquity: 49°

6293 Pl. #1

Powder: 21.664

Gun No.: 44747

[illegible]

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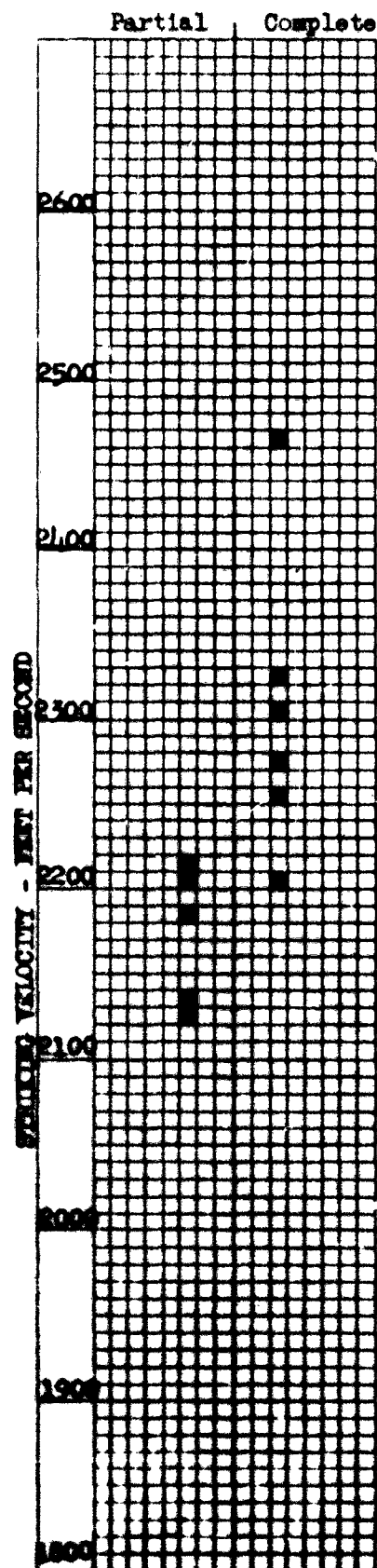
ROUND-BY-ROUND DATA

FIRING RECORD NO.

DATE: 14 Apr 11 1959

Material: Aluminum
Submitted by: Frankford Ars.
Type of Test: Development
Size: 1.024" x 30" x 30"
Reference Pl. No.
Submitting Agency: J6293 Pl. #1
Material: 7075

Projectile: Cal .30 AP, M2
Gun to 1st Screen: 11.68'
1st Screen to 2d Screen: 10.04'
2d Screen to Plate 10.34'
Obliquity: 30°
Powder: 4759
Gun No.: 1512536

[illegible]

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2. 4. 4

FIRING RECORD NO.

Projectile: Cal .30AP, M2
Gun to 1st Screen: 11.68'
1st Screen to 2d Screen: 10.04'
2d Screen to Plate 13.74'
Obliquity: 45°
Powder: 4759 - 21664
Gun No.: 1512536 - 44747

DATE: 14 Apr 11 1959

Partial , Complete

STANDARD VELOCITY - FEET PER SECOND

STANDARD TEMPERATURE - DEGREES F

STANDARD TEMPERATURE - DEGREES F	STANDARD VELOCITY - FEET PER SECOND
70	2550
75	2650
80	2750
85	2850
90	2950
95	3000
100	3050

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姓名: 性别: 年龄: 职业: 住址: 电话: 电子邮箱: 邮编: 备注:

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CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

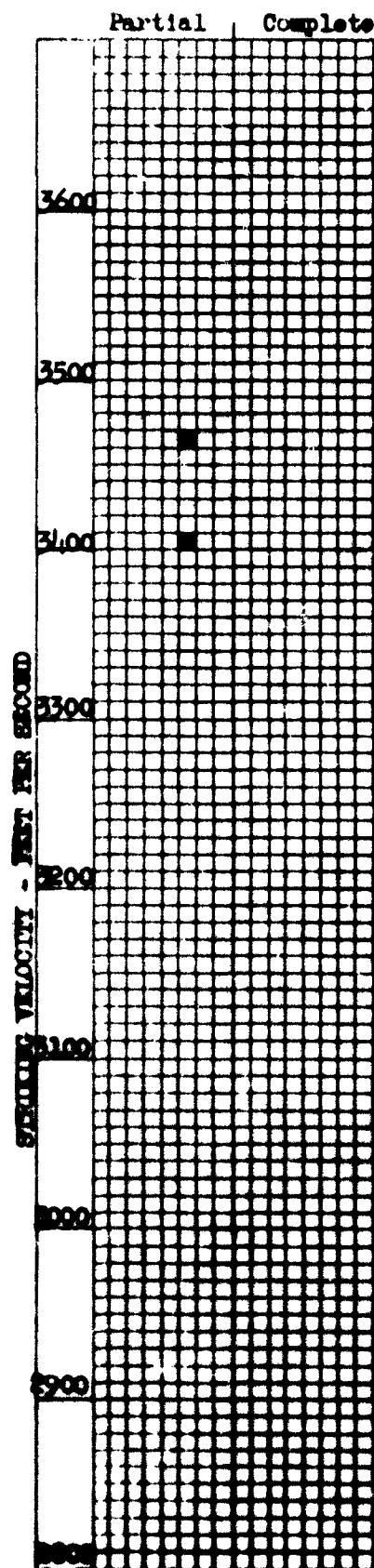
ROUND-BY-ROUND DATA

FLYING JEW: RD NO.

DATE: 15 April 1959

Material: Aluminum
Submitted by: Frankford Ars.
Type of Test: Development
Size: 1.024" x 30" x 30"
Pl. No. 3693 Pl. #1

Projectile: Cal .30 AP, M2
Gun to 1st Screen: 11.68'
1st Screen to 2d Screen: 10.04'
2d Screen to Plate 15.34'
Obliquity: 60°
Powder: 24664
Gun No.: 44747

[illegible]

3-25

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

2. 2008年

FLYING RECORD NO.

Material: Aluminum

Projectile: Cal .50 AP, M2

Submitted by: Frankford Ars.

Gun to 1st Screen: 7.65'

Type of Test: Development

1st Screen to 2d Screen: 12.02'

Size: 1.024" x 30" x 30"

2d Screen to Plate 16,50'

Pl. No.

Obliquity: 60°

6293 P1. 42

Powder: 35683

Gun No.: 22

STATIONARY VELOCITY - FEET PER SECOND	Partial	Complete
3300		
3200		
3100	■	
3000		
2900		
2800		
2700		
2600		
2500		

THE NEW YORK TIMES

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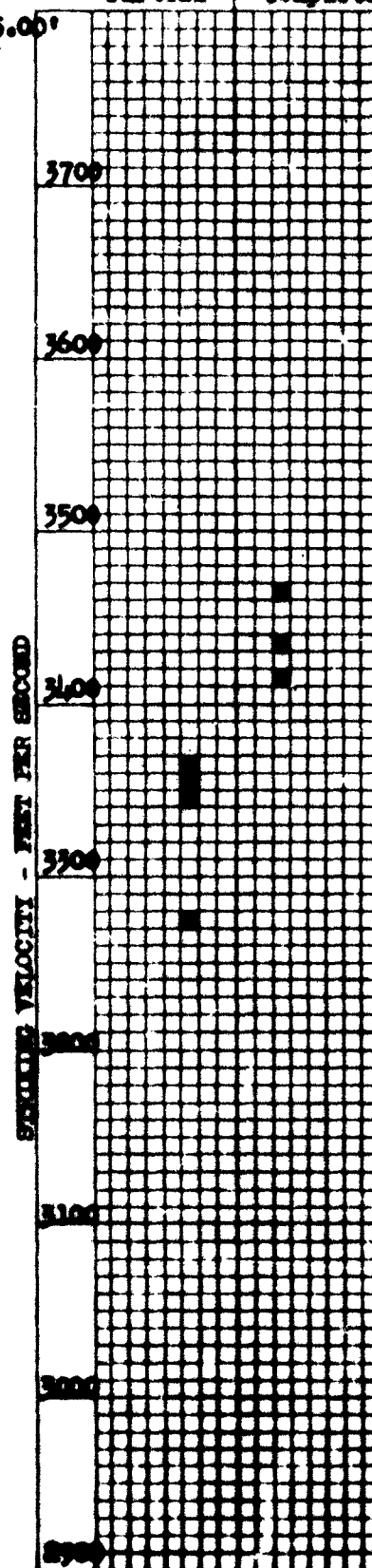
CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

FILING RECORD NO.

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: 1.67"x1.6"x36"
Status: Pl. No.
Frankford
H5269-40

Projectile: cal .30 Ball M2
Gun to 1st Screen: 60.65' 21.65'
1st Screen to 2d Screen: 19.57' 15.00'
2d Screen to Plate 182.07' 18.40'
Obliquity: 0°
Powder: 21664
Gun No.: 114717

Partial , Complete

[illegible]

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CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

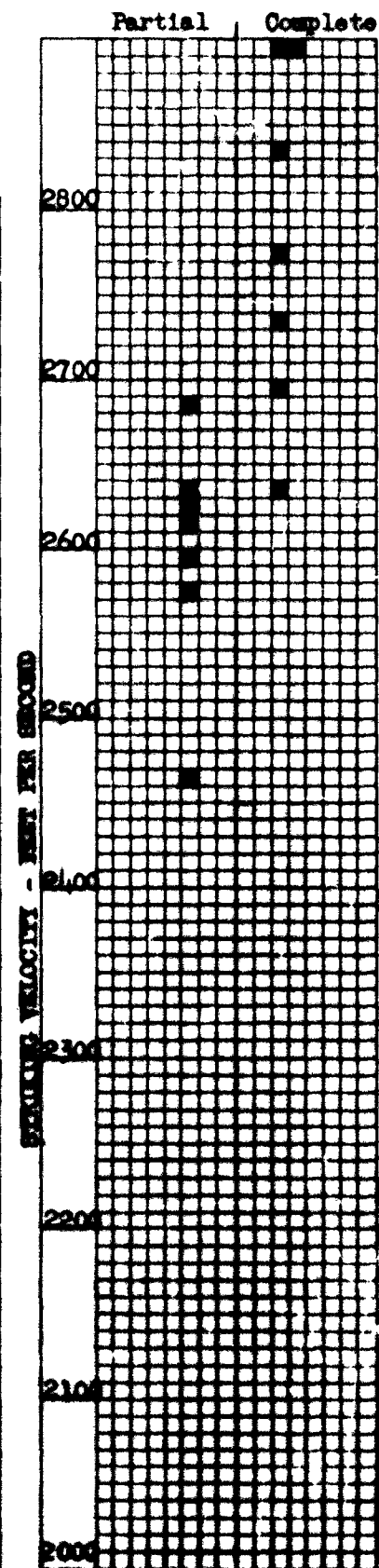
ROUND-BY-ROUND DATA

FILING RECORD NO.

DATE: 3 April 1959

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: 1.497" x 18" x 36"
Sizing Plate No.
Submitting Agency H6289-4C
Material Test

Projectile: Cal .30 AP M2
 Gun to 1st Screen: 60.65'
 1st Screen to 2d Screen: 49.57'
 2d Screen to Plate 182.07'
 Obliquity: 30°
 Powder: 24664
 Gun No.: 44747

[illegible]

2017年12月31日 星期一

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

3 Dec 92

MODIFIED BY: [REDACTED] AUTHORIZED

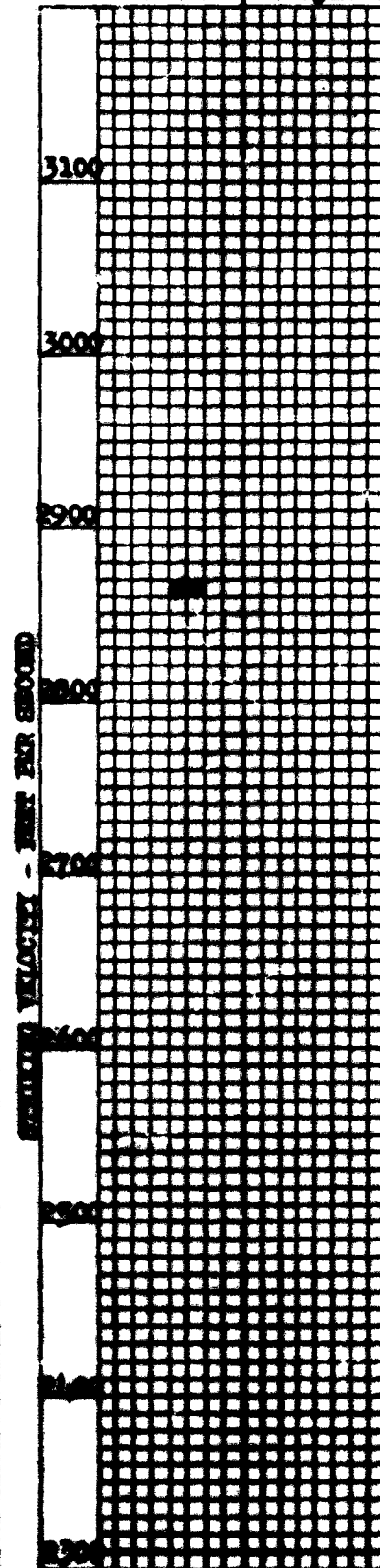
FIRING RECORD NO.

Material: Aluminum
Submitted by: Frankford
Type of Test: Development
Size: 1.67" x 18" x 36"
Reference: Plate No.
Drawing: E288-1A
Weight: 0.0000

Projectile: Cal .50 Ball M2
Gun to 1st Screen: 60.68'
1st Screen to 2d Screen: 49.71'
2d Screen to Plate 187.24'
Obliquity: 60°
Powder: 35683
Gun No.: 22

DATE: 6 April 1959

Partial Complete

[illegible]

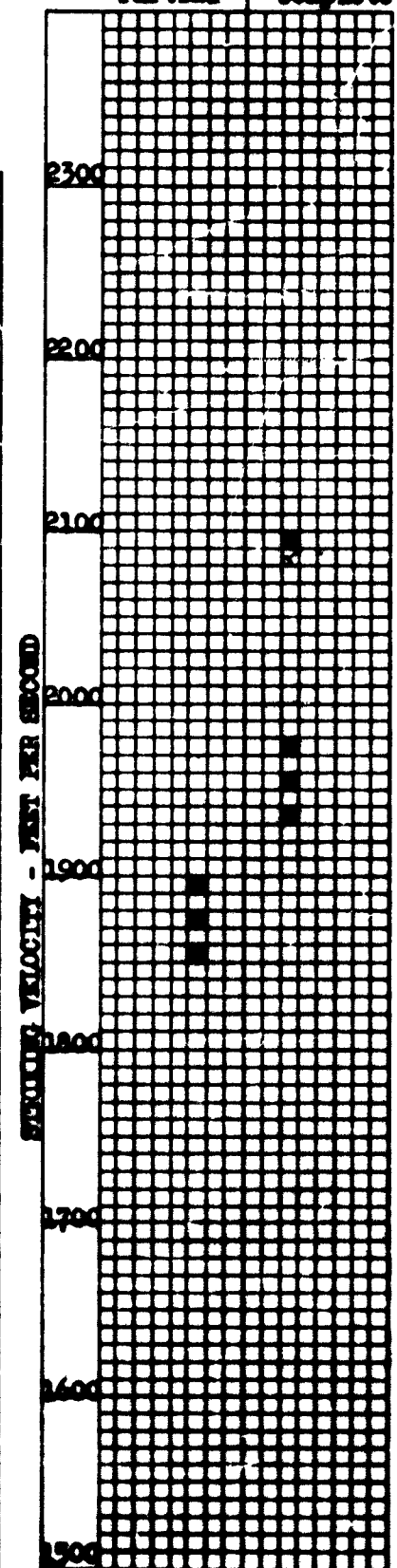
CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

MODIFIED ROUND-BL-ROUND DATA

DATE: 6 April 1959

Projectile: Cal .50 AP M2
Gun to 1st Screen: 60.68'
1st Screen to 2d Screen: 49.71'
2d Screen to Plate 183.24'
Obliquity: 30°
Powder: 35683
Gun No.: 22

Partial , Complete

[illegible]

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

FORM 1-60 (Rev)
1-60-12

FIRING RECORD NO.

Projectile: Cal .50 AP, M2
Gun to 1st Screen: 60.68' 10.03'
1st Screen to 2d Screen: 19.71 10.03'
2d Screen to Plate 157.24' 15.70'
Obliquity: 60°
Powder: 35683
Gun No.: 22

DATE: 6 APR 11 1979
10 APR 11 1979

Partial Complete

[illegible]

PERCENTAGE VELOCITY - PERCENT PER SECOND

Run	Percentage Velocity (Percent per Second)
1	21.05
2	21.15
3	21.25
4	21.20
5	21.30
6	21.25
7	21.35
8	21.20
9	21.30
10	21.25
11	21.35
12	21.20
13	21.30
14	21.25
15	21.35
16	21.20
17	21.30
18	21.25
19	21.35
20	21.20
21	21.30
22	21.25
23	21.35
24	21.20
25	21.30
26	21.25
27	21.35
28	21.20
29	21.30
30	21.25
31	21.35
32	21.20
33	21.30
34	21.25
35	21.35
36	21.20
37	21.30
38	21.25
39	21.35
40	21.20
41	21.30
42	21.25
43	21.35
44	21.20
45	21.30
46	21.25
47	21.35
48	21.20
49	21.30
50	21.25
51	21.35
52	21.20
53	21.30
54	21.25
55	21.35
56	21.20
57	21.30
58	21.25
59	21.35
60	21.20
61	21.30
62	21.25
63	21.35
64	21.20
65	21.30
66	21.25
67	21.35
68	21.20
69	21.30
70	21.25
71	21.35
72	21.20
73	21.30
74	21.25
75	21.35
76	21.20
77	21.30
78	21.25
79	21.35
80	21.20
81	21.30
82	21.25
83	21.35
84	21.20
85	21.30
86	21.25
87	21.35
88	21.20
89	21.30
90	21.25
91	21.35
92	21.20
93	21.30
94	21.25
95	21.35
96	21.20
97	21.30
98	21.25
99	21.35
100	21.20

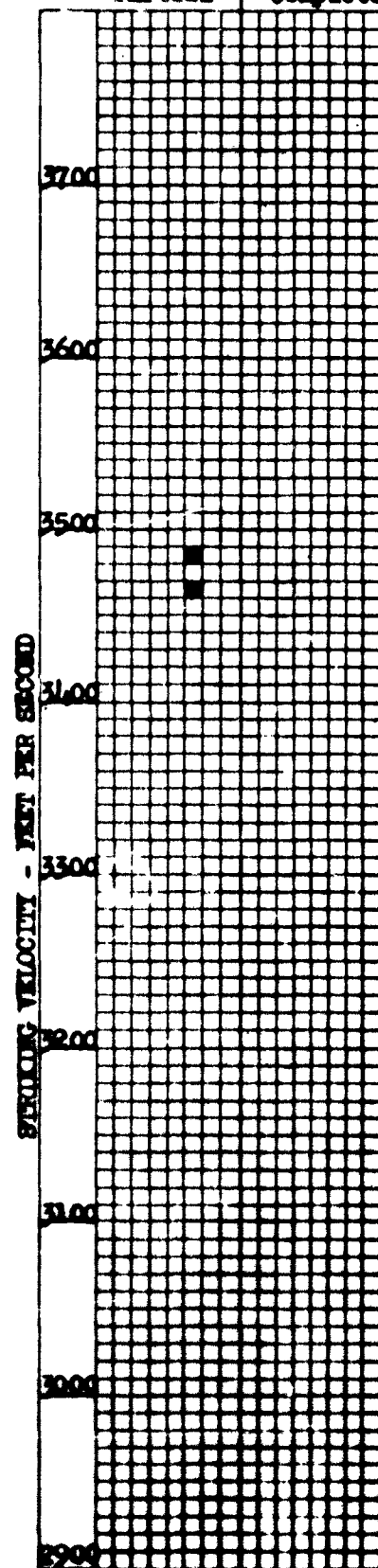
CABEC 13.1 Rev.
2 Dec 82

FIRING RECORD NO.

DATE: 9 April 1959

Projectile: Cal .30 Ball, M2
Gun to 1st Screen: 11.53'
1st Screen to 2d Screen: 20.00'
2d Screen to Plate 9.05'
Obliquity: 0°
Powder: 21.664
Gun No.: 44,747

Partial Complete

[illegible]

1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

ROUND-BY-ROUND DATA

FIRING RECORD NO.

MODIFIED HANDLING AUTHORIZED

DATE: 9 April 1959

Material: Aluminum

Projectile: Cal .50 AP, M2

Submitted by: Frankford Ars.

Gun to 1st Screen: 11.53'

Type of Test: Development

1st Screen to 2d Screen: 10.00'

Size: 1.767" x 18" x 36"

2d Screen to Plate 10.45'

Remarks

Pl. No.

Obliquity: 30°

Batch: 734-871(2)

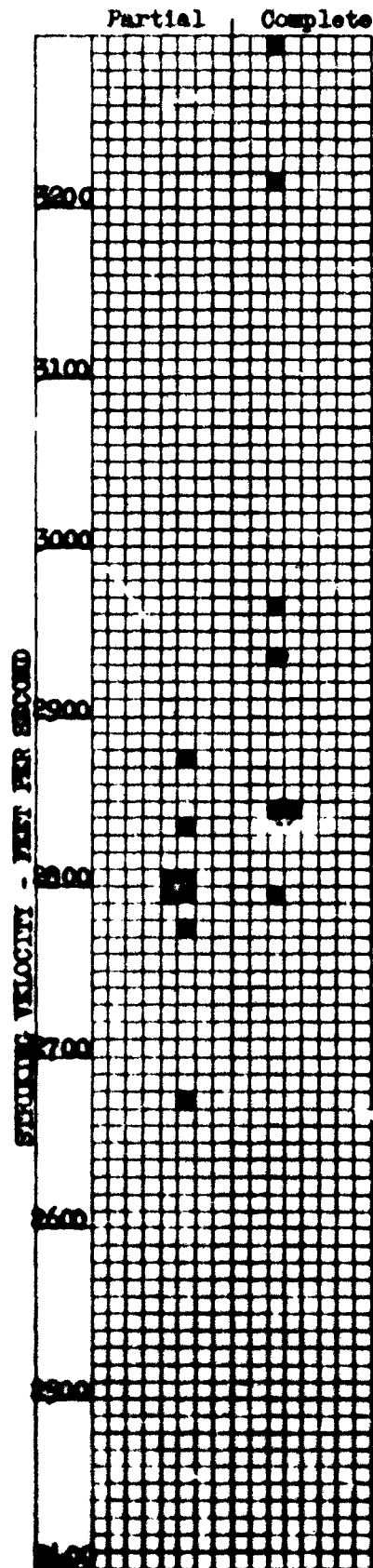
734-871(2)

Powder: 21,664

Weight: 14.747

Gun No.: 14,747

Pt. No.	Charge	Velocity	Result	Rd No.	Charge	Velocity	Result
	Grains	fps			Grains	fps	
1	70	3333	CP(P)	17	62	2968	CP(P)
2	66	3214	CP(P)	18	61	2833	Dis.
3	60	2798*	CP(P)	19	62	2933	CP(P)
4	58	2775	PP(P)	20	61	2849*	CP(P)
5	60	2847*	CP(P)				
6	58	2678	PP(P)				
7	59	Lost	Dis.				
8	59	Lost	PP(P)				
9	59	2799	PP(P)				
10	60	2830*	PP(P)				
11	60 +	2806*	PP(P)				
12	61	2806	PP(P)				
13	62	2799	PP(P)				
14	62	Lost	Dis.				
15	62	Lost	CP(P)				
16	60	2874*	PP(P)				
M50 Ballistic Limit (Protection) = 2834 fps							
High Partial Penetration = 2874 fps							
Low Complete Penetration = 2798 fps							
Spread = 76 fps							
CONFIDENTIAL							
MODIFIED HANDLING AUTHORIZED							



REC'D 12.7.77
J. D. 44

FIRING RECORD NO.

Projectile: Cal .50 Ball M2
Gun to 1st Screen: 60.63'
1st Screen to 2d Screen: 49.71'
2d Screen to Plate 183.29'
Obliquity: 30°
Powder: 35683
Gun No.: 22

DATE: 7 April 1959

Partial Complete

Striking Velocity - FEET PER SECOND

Striking Distance (Feet)	Striking Velocity (Feet per Second) - Partial	Striking Velocity (Feet per Second) - Complete
10	1550	
20	1600	
30	1650	
40	1700	
50	1750	
60	1800	
70	1850	
80	1900	
90	1950	
100	2000	
110	2050	
120	2100	
130	2150	
140	2200	
150	2250	
160	2300	
170	2350	
180	2400	
190	2450	
200	2500	
210	2550	
220	2600	
230	2650	
240	2700	
250	2750	
260	2800	
270	2850	
280	2900	
290	2950	
300	3000	
310	3050	
320	3100	
330	3150	
340	3200	
350	3250	
360	3300	
370	3350	
380	3400	
390	3450	
400	3500	
410	3550	
420	3600	
430	3650	
440	3700	
450	3750	
460	3800	
470	3850	
480	3900	
490	3950	
500	4000	
510	4050	
520	4100	
530	4150	
540	4200	
550	4250	
560	4300	
570	4350	
580	4400	
590	4450	
600	4500	
610	4550	
620	4600	
630	4650	
640	4700	
650	4750	
660	4800	
670	4850	
680	4900	
690	4950	
700	5000	
710	5050	
720	5100	
730	5150	
740	5200	
750	5250	
760	5300	
770	5350	
780	5400	
790	5450	
800	5500	
810	5550	
820	5600	
830	5650	
840	5700	
850	5750	
860	5800	
870	5850	
880	5900	
890	5950	
900	6000	
910	6050	
920	6100	
930	6150	
940	6200	
950	6250	
960	6300	
970	6350	
980	6400	
990	6450	
1000	6500	
1010	6550	
1020	6600	
1030	6650	
1040	6700	
1050	6750	
1060	6800	
1070	6850	
1080	6900	
1090	6950	
1100	7000	
1110	7050	
1120	7100	
1130	7150	
1140	7200	
1150	7250	
1160	7300	
1170	7350	
1180	7400	
1190	7450	
1200	7500	
1210	7550	
1220	7600	
1230	7650	
1240	7700	
1250	7750	
1260	7800	

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CONFIDENTIAL--MODIFIED HANDLING AUTHORIZED

MODIFIED ROUND 19 ROUND 18 AUTHORIZED

DATE: 6 April 1959

Projectile: Cal .50 AP M2
Gun to 1st Screen: 60.68'
1st Screen to 2d Screen: 19.71'
2d Screen to Plate 183.24'
Obliquity: 30°
Powder: 35683
Gun No.: 22

Category	Spinning Velocity (Feet Per Second)
Partial	1920
Complete	2150